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# METAL INDUSTRY

VOL. 38, NO. 1

FABRICATION · ASSEMBLING · PLATING · FINISHING

JANUARY, 1940

## Throwing Power

The use of minimum thickness specifications for plated coatings has focused the attention of the industry on methods for obtaining uniform distribution of these coatings, or in other words, good throwing power. Throwing power depends fundamentally chiefly upon primary current distribution and the change in cathode polarization with current density. All other conditions being equal, if no change in cathode polarization took place with changes in current density, then the thickness of the deposit on the surfaces being plated, would be dependent simply upon the primary current distribution.

Many tests have been proposed for the measuring of throwing power, some of the more well-known proposals being: that of Blum and Haring, which involves the use of a cell with two cathodes at unequal distances from the anode; the Krumholz method, which involves the measurement of the distribution of the electrodeposit on a uniform wire as a cathode projecting towards a flat anode; bent cathode methods suggested by Pan and others which involve the use of a cathode bent at an angle.

Work published during the past year has helped to clarify, to a considerable extent, various problems pertaining to throwing power. The work of Kasper has been notable in this connection, and he has shown, both mathematically and experimentally, the current distribution on various types of cathodes.

Kasper showed that better throwing power can be obtained only by varying the distance of the anode to the cathode within a distance equal to several thicknesses of the work being plated, and the removal of the cathode to any distances greater than several times the thickness of the work being plated, would have little effect on the current

density distribution or on throwing power. This has also been corroborated experimentally by Gardam.

Hogaboom has recently proposed the suggestion that discrepancies and lack of correlation between various methods of determining throwing power with actual practice, may be due to some extent, to non-homogeneity of the cathode film due to the orientation of the surfaces of the object being plated. This non-homogeneity would be correlated with the relative ease of diffusion and convection on the various surfaces of the cathode.

Throwing power of solutions can be affected by many factors, most of which in turn affect cathode polarization. These factors include the composition of solution, operating temperature, diffusion phenomena and the relative velocity of movement between the anode and the cathode. In regard to this last point, it has been pointed out by Baker, from analogy between gases and metal surfaces, that effective diminution of the depleted cathode layer can be effected more readily by movement of the cathode itself through the solution, such as takes place in automatic plating, than by movement or agitation of the solution, leaving the work constant.

Increase in temperature of the solution usually results in a decrease in throwing power because it decreases the rate of change of polarization with current density. However, an increase in temperature also increases the conductivity of the solution which has a tendency to increase the throwing power and the net effect, therefore, of an increase in temperature, cannot be generalized.

An increase in current density usually results in poorer throwing power, particularly for nickel plating solutions. This fact may be obscured by the greater thickness of deposit formed by an increase in current density, thus concealing the fact

that the ratio of the thickness of deposit between depressed portions and prominent portions is greater.

To the non-technical man, discussions of throwing power stating that changes in polarization with various factors may alter effective current distribution, resulting in more uniform distribution of the electrodeposit, are somewhat confusing.

However, in actual practice, other factors may enter into the picture, one of these being the change in cathode efficiency with current density. Thus, if a high point had 10 amperes of current per unit of area, and a low point had 1 ampere, the ratio of the deposit would be 10 to 1, if the cathode efficiencies were the same at 1 and 10 amperes per sq. ft.

A simple discussion of this phenomenon is as follows: If a piece of work is hung in a solution, the current density on various portions of the article is dependent primarily on the geometrical shape of the object with, of course, the depression portions having much lower current density than the elevated portions, and if current is passed, the amount of plate deposited would be proportional to this effective current distribution, if no other factors were involved.

This may be true at least as far as this factor is concerned for high cathode efficiency solutions, or for solutions whose efficiencies do not vary markedly with changes in current density, such as acid copper, nickel or cadmium. However, for example, with cyanide copper solutions where the cathode efficiency may be 90% at 1 ampere per sq. ft. and which may drop to 70% at 10 amperes per sq. ft., the distribution of plate in this case then would be more nearly 8 to 1, rather than the 10 to 1 value based on the primary current distribution.

Another important factor, cathode polarization, may for simplicity, be likened to a sort of resistance film formed at the cathode by the passage of current. Neglecting screening effects of the cathode and rack, the primary current distribution on an object would be dependent upon the relative distances of the various parts of the object from the anode, inasmuch as the ratios of distances represent the ratios of the resistance of the solution from the anode to the points concerned.

If the polarization increases to a greater extent on the elevated parts of the object to be plated

than on the recessed parts, then the total electrical resistance from the anode to the elevated points, namely, the sum of the bath resistance and polarization resistance, may be made more nearly equal to that of the recessed points, resulting in more nearly equal current densities and thickness of deposit.

Other factors may influence the popular conception of throwing power, such as for example, the limiting current density for metal deposition in chromium plating, and depositing of metals on base metals with higher solution potentials than the depositing metal, such as nickel plating on zinc and silver plating on copper or steel.

Almost unlimited throwing power as observed with anodic oxidizing solutions and black molybdenum plating solutions is due fundamentally to none of the factors mentioned. In these cases, oxides are formed or deposited which progressively insulate the areas being oxidized or coated and thus the current being passed must eventually be shifted to the most remote portion of the work. The uniformity of thickness of oxide formed depends largely on how rapidly nearly complete insulation results from the oxide layer being formed and to some degree on the rate of solubility of the oxide in the solution.

The more one critically examines the various methods available for measuring throwing power, the more one is apt to conclude that the only sure way of determining whether throwing power will be satisfactory for the objects concerned, is to run actual experiments on the objects which are to be plated, or at least on objects as similar as possible to those to be plated. We would more likely obtain correlation between experimental tests and practice, for example, on deeply recessed boxes by using a smaller cathode shape in this manner rather than a bent cathode, a flat sheet or a wire. In addition, the experimental conditions should approximate those of actual practice as far as possible in regard to ratios between anode and cathode distances and the work thickness, temperature, agitation and current density.

From the foregoing discussion, it is obvious that the subject of throwing power is one about which volumes of future discussions may be written without any two observations arriving at the same conclusion, or entering into complete agreement. This subject almost ranks with the amorphous metal postulation as a source of abortive prolixity.



# New Electroplating Products and Processes Developed in 1939

By Dr. Walter R. Meyer

Editor

The year witnessed many outstanding developments for improving the quality of plated coatings and for reducing production costs. Considerable attention was paid to plating of strip and sheet metal to be used for fabrication, and to obviate the need for subsequent plating. Developments of importance took place in current generating apparatus, cleaning, tank linings, rack coatings, polishing, buffing, pickling, and in fact, almost every phase of electroplating. This review is not intended to be complete, but it is hoped that the major developments have been included.—Ed.

## ZINC DIE CASTINGS

Real progress has been made towards the establishing of standard specifications for plated coatings on zinc<sup>1</sup>.

Black molybdenum coatings have been applied to zinc and a more widespread use of plated zinc die castings has occurred. Baking finishes requiring only a short bake at higher temperatures than normal were of interest for the organic finishing of zinc die castings, and the automobile industry is making wider use of decalcomania finishes.

The steel producers have continued to show active interest in the development and application of methods for obtaining heavy, ductile zinc coatings on steel and pilot operations were performed on the zinc plating of large steel strip.

## PRE-PLATED METAL

A wide variety of design of finish was introduced on pre-plated metal<sup>2</sup> by alternating bright and satin strips of equal widths.

Protex covered nickel and chromium plated metal<sup>2</sup> has been offered to protect the finish until use.

Brilliant colors are now available<sup>3</sup> on tinplate, steel, brass or zinc. These

colors include green, red, brass, gold and copper, and can be had in sheets or coils. The metal can be formed and stamped within certain limits without harming the finish.

Five distinguished patterns of crimped metal strip and plated stock<sup>2</sup> have also been offered.

Two new grades of steel base metals have been added to the line of bonded metals<sup>3</sup>, namely nickel steel and chromium steel.

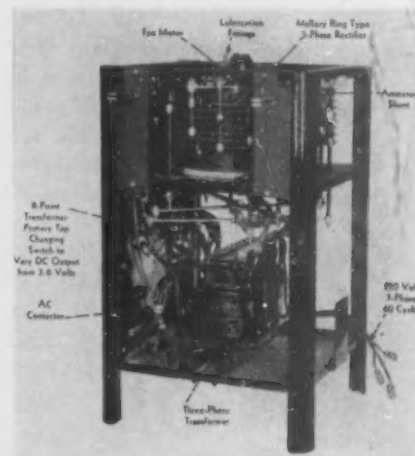
The first commercial production of nickel plated aluminum and chromium plated aluminum sheet<sup>3</sup> occurred during the year. These new metals withstand temperatures from 500° to 750° F., without discoloration of the surface. They offer the decorative and corrosion resistant qualities of chromium or nickel and the functional qualities of aluminum.

1. New Jersey Zinc Co., 160 Front St., New York.
2. Apollo Metal Works, 66th Pl. and S. Oak Pk. Ave., Chicago, Ill.
3. American Nickeloid Co., Peru, Ill.

## RECTIFIERS—GENERATORS

There was considerable activity during the year on production and new uses for rectifiers. The standard rectifiers<sup>1</sup> available have been im-

proved, thereby increasing their practicability. Two companies announced the sale and development of rectifiers; one<sup>2</sup> being a fan-cooled copper oxide rectifier built in standard sectional units with an output capacity of 1.8 kilowatts. Two current ratings are available, namely six volts and twelve volts. The rating for a six volt section therefore is 300 amperes and the twelve volt unit, 150 amperes. Hand-operated voltage regulators are offered for use with these rectifiers.



Interior view of 500 ampere-7½ volt rectifier<sup>3</sup>.

Another line of rectifiers<sup>3</sup> using the magnesium-copper sulfide dry disc type of rectifier in a ring type assembly has been offered for sale. This type of plate is said to carry a current density of 57 amperes D.C. per square inch of active rectifying area. Control of the output is by means of a multi-point switch selecting different transformer primary taps. A 3000 ampere 7½ volt rectifier assembly has been in use for the past year in a large electrotyping plant.

Copper oxide-type rectifiers<sup>1</sup> have also found use during the year for



electrotyping and a large 3000 ampere, 6 volt rectifier has been in use at the Shane-Beever Company, Baltimore, Md.

An interesting motor generator unit<sup>1</sup> made during the year was a set consisting of three 36 volt 7500 ampere generators driven by a 1750 h.p. synchronous motor.

1. Hanson-Van Winkle-Munning Company, Matawan, N. J.
2. General Electric, Bridgeport, Conn.
3. P. R. Mallory & Co., Inc., Indianapolis, Ind., Rectifier Sales Div.



## Developments in Aluminum Finishes

by

**Ralph E. Pettit**

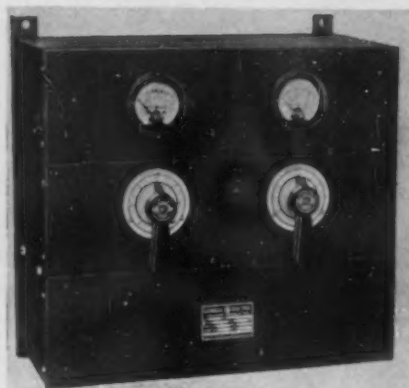
*Sales Engineer*

*Aluminum Company of America*

The year 1939 was the best in the history of the aluminum industry, and increased tonnages of the metal were given to its many finishes. There were few changes in the finishes themselves, but the past year saw an increase in their usefulness in many fields. New products were made commercially from aluminum for the first time because of the desirable characteristics imparted by the various coatings available.

Alcoa lighting sheet, made by the Aluminum Company of America, found use in highway signs and markers, an important installation being made on the Henry Hudson Parkway, New York City's new superhighway. The sheet used for this purpose is specially processed to give it countless indentations and projections of mirror-like surfaces from which the light reflects at many angles. The signs are legible both day and night since they reflect dim auto lights, even at a distance.

Among the applications of Alcoa lighting sheet in 1939 were the new miner's safety lamps; the 63,000 reflectors employed in lighting the two World's Fairs; and the trough-like reflectors utilized in the recently developed fluorescent lighting systems. Such sheet also found use in a field far removed from lighting; namely, in the storage and shipment of certain chemicals whose corrosive attack it effectively resists.



*Hand-operated voltage regulator<sup>2</sup>.*

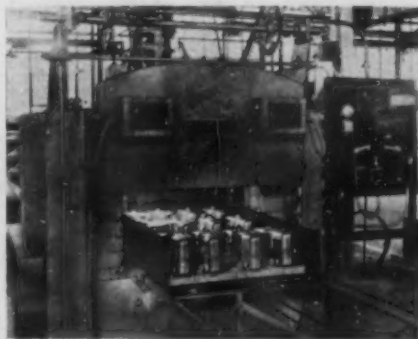


For use in the most severe exposures, aluminum reflectors may now be coated with a colorless plastic which facilitates cleaning and improves the wearing characteristics.

The usefulness of aluminite coatings was extended to die castings with the introduction of a new die casting alloy. An aluminum die casting, finished in color by means of the Aluminite process, is being used in the production of beer dispensing knobs.

While aluminum name plates are not new, they were for the first time decorated with halftones and shaded colors. Excellent reproductions of photographs have been made on anodically treated plates.

In the refrigerator industry, the trend has been toward the use of combinations of enameled and Aluminite finishes. For instance, the lettering of the trade name may be recessed and given a baked enamel coating in a contrasting color.



*Furnace brazing of aluminum alloy gasoline tanks for outboard motors. After brazing, these tanks are dressed down at the joint and given an Alrok finish and a coat of aluminum paint.*

For the fourth consecutive year, the State of Connecticut is using, in 1940, a permanent aluminum license plate finished by the Aluminite process, and in the past year it also adopted a permanent operator's license made from aluminum. The State of Arkansas will use aluminum plates for the second year.

Alrok, a comparatively new and inexpensive chemical-dip finish, was used more in 1939 than in the preceding year, especially as a base for paint. The gasoline tanks of aircraft transports are given this finish to increase their resistance to corrosion.

The past year has also seen the installation of a number of plants for producing the Krome-Alume finishes, whereby chromium, nickel and other metals may be electroplated on aluminum. These finishes are applied on miscellaneous aluminum parts, including meat slicers, camera cases and band batons.

A very interesting finishing development announced in 1939 was the painting of portraits on an aluminum base which is opaque and does not deteriorate. The colors acquire a brilliance not possible when canvas is used, and unusual effects can be obtained from illuminated portraits. Applications of the metallic mural are expected in ultra-modern buildings, streamlined trains and transport planes.

An important advance of the past year in the fabrication of aluminum is the brazing process, which permits the joining of much thinner gauges than can be arc- or torch-welded. Outboard motor gasoline tanks, assembled in this way, are dressed down at the joint, then given an Alrok finish and a coat of aluminum paint. The new process, which is especially adapted to batch production, is expected to mean as much to the aluminum industry as the development of welding did a number of years ago.

### TANKS AND TANK LININGS

An outstanding development<sup>1</sup> in tanks was a series of new *spray rinse tanks* which develop a vortex type dense mist accomplishing thorough rinsing in a short period of time with resultant economies in water consumption and reduction in rejects due to thorough rinsing.



Hand-lever type of spray rinse tank for general and special production use<sup>1</sup>.

A plating tank<sup>2</sup> for barrel plating has been designed employing a unique construction which consists of a series of small ducts directly over the anode rods connected with the main duct on the side. This construction allows for a complete exhaust and unobstructed use of the tank.

Hard rubber linings for plating tanks and for plating accessories have been applied on an increasing scale<sup>3</sup>. Improvements were made on both rubber construction and synthetic materials.

Tanks<sup>4, 5</sup> lined with synthetic rubber-like materials have been announced which withstand the action of oxidizing acids as well as plating solutions. Linings are available which



Tank lined with sheets of Koroseal will withstand temperatures up to 150°F<sup>5</sup>.

will withstand acids used in pickling stainless steel.

Better linings for bright nickel plating have been made available by the development of a *triple lining*<sup>6</sup> which consists of three layers of rubber, one of soft consistency which is attached to the metal, the middle layer of harder rubber and an outer layer of a new soft compound, provided with expansion joints to prevent cracking.

The entry of corrosive solutions into the joints of tank coatings has been obviated by the use of a new *seamless rubber covering*<sup>6</sup> and by a new *sealing material*<sup>7</sup> which is stated to have a high dielectric value and to be very resistant to acids, alkalis and other corrosive agents.

A new flexible, elastic, soft protective coating called *Impervium*<sup>7</sup> has been developed to coat and protect concrete, porous materials, and plating equipment from all types of acids, alkalis, oils and other corrosive media.

1. Storts Welding Co., 42 Stone St., Meriden, Conn.
2. Hanson-Van Winkle-Munning Company, Matawan, N. J.
3. American Hard Rubber Co., 11 Mercer St., New York City.
4. The United States Stoneware Co., Akron, Ohio.
5. B. F. Goodrich Company, Akron, Ohio.
6. Belke Manufacturing Co., 947 N. Cicero Ave., Chicago, Ill.
7. Paramount Rubber Service, Inc., 1430 Rosedale Court, Detroit, Mich.

## CLEANERS

One of the feature developments of the year in cleaning materials, was a compound for *anodic cleaning* of steel and copper parts to remove oils, greases, carbon smut and the like.<sup>1 2 3</sup>

Other electrocleaners for this purpose<sup>4 5</sup> involve the use of cathodic cleaning with or without anodic cleaning. These cleaners are particularly recommended for cleaning of steel previous to bright nickel plating.

An alkali cleaner<sup>1</sup> was announced for the cleaning of nickel plated parts previous to chromium plating, which is stated to have high resistance against contamination from chromium salts, and is said not to discolor the nickel surface being cleaned.

A difficult problem of cleaning oil-quenched work, carburized in a



Cleaning a greasy engine by the use of a steam gun<sup>10</sup>.

liquid bath is said to be overcome by a new high concentration alkali cleaner<sup>6</sup> with high wetting power.

## DEGREASING

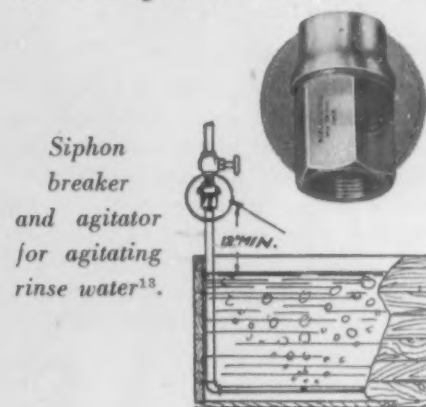
The chief developments in solvent degreasing were the use of automatic rotating baskets<sup>7 8</sup> for the cleaning of cup-shaped articles to prevent entrapment of the solvent and to accomplish a thorough cleaning job, and a one-dip type machine with good cleaning action made possible by the use of continuous distillation and filtration<sup>9</sup>.

The difficult problem of removing solid dirt as well as oils in degreasing, has been overcome to a large measure by employing a pressure spraying technique.

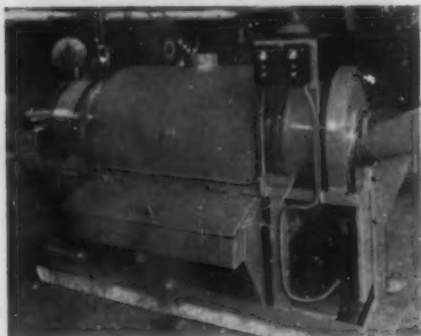
Equipment for other cleaning, included the development of several types of spray nozzles for washing machines, giving flat, atomized, whirl-jet and parasol type sprays<sup>9</sup>.

An improved steam gun has made possible effective cleaning of heavily contaminated objects in difficultly accessible places<sup>10</sup>.

Tumbling cleaning barrel cylinder equipment made of steel or Monel metal has been built for cleaning large volumes of automobile parts<sup>11</sup>, and a small continuous drum type cleaning machine<sup>12</sup>, has been made for cleaning screw machine work,







Continuous drum type cleaning machine<sup>12</sup>.

small stampings and the like. In this machine a patented drum head maintains a level of cleaning compounds in this section, and passes the work without dropping. A spray wash follows the soaking rinse.

The proper rinsing of work after being cleaned has been facilitated by two developments; one<sup>13</sup>, a siphon breaker and agitator for accomplishing air agitated water rinsing, and the other being a series of spray rinse tanks<sup>14</sup>, which enable complete and economical rinsing to be accomplished in a short time by the use of specially designed and located syringing nozzles and control.

1. MacDermid, Inc., Waterbury, Conn.
2. Puritan Mfg. Co., Waterbury, Conn.
3. Magnus Chemical Co., Garwood, N. J.
4. Frederick Gumm Chemical Co., Inc., 538 Forest St., Kearny, N. J.
5. Magnuson Products Corp., Brooklyn, N. Y.
6. E. F. Houghton & Co., 3rd, American and Somerset Sts., Philadelphia, Pa.
7. G. S. Blakeslee & Co., 19th St. and 52nd Ave., Cicero Sta., Chicago, Ill.
8. Detroit Rex Products Co., 13005 Hillview Ave., Detroit, Mich.
9. Spraying Systems Co., 4922 W. Grand Ave., Chicago, Ill.
10. Oakite Products, Inc., 14 Thames St., N. Y.
11. The Udylyte Corp., Detroit, Mich.
12. N. Ransohoff, Inc., W. 71st at Mill Creek, Carthage, Cincinnati, Ohio.
13. Beaton & Caldwell Mfg. Co., New Britain, Conn.

#### PICKLING AND DESCALING

Several outstanding developments occurred in the pickling field during the year, one of which was a *pickling treatment*<sup>1</sup> for stainless steel which produces a brilliant etch on the stainless steel suggestive of silver. An *addition agent*<sup>2</sup> has been marketed, which is claimed to be stable in both hot sulfuric and cold hydrochloric acid pickles, and which reduces acid loss by dragout and by reducing the attack on the base steel. It also im-



Safety acid carboy pourer<sup>3</sup>.

parts a cleaning and penetrating action to the pickles because of its marked lowering of the surface tension.

Other developments included a *safety carboy pourer*<sup>3</sup> which allows easy handling of acid carboys by one man; and *fans*<sup>4</sup> for the exhausting of corrosive pickling acid fumes, these fans being treated with multiple coats of corrosion resistant phenolic type coatings.

Several types of *heating coils* for acid solutions have been marketed, one<sup>5</sup> being made of impervious carbon with high heat conductivity between that of steel and copper and another<sup>6</sup>, stoneware coils of one piece which withstand 35 lbs. of steam pressure.

During the year, announcements of *tanks*<sup>7 8 9</sup> handling oxidizing acids were made. One of these new developments is a plasticized polyvinyl chloride which has remarkable corrosion resistance to sulfuric acid up to and including 66° Be, nitric acid in all concentrations, hydrochloric acid in all concentrations, alkaline solutions, as well as a host of other normally corrosive chemicals. Glass fabric tank linings<sup>6</sup> impregnated with Pyroflex were developed to give mechanical strength and high corrosion resistance.

*Airless blast equipment* available was augmented during the year by the development of a new small capacity airless wheelabrator<sup>10</sup> for cleaning and finishing ferrous and non-ferrous heat treated parts in limited lots.

1. U. S. Patent No. 2,172,421—Chemical Foundation, Inc., New York City.
2. The Enthone Co., New Haven, Conn.
3. Lewis-Shepard Sales Corp., 245 Walnut St., Watertown, Mass.
4. The Autovent Fan & Blower Co., Chicago, Ill.



Exhaust fan with Heresite coating for exhausting corrosive fumes<sup>4</sup>.

5. Heil and Company, 3088 W. 106th St., Cleveland, Ohio.
6. Maurice A. Knight, Kelly Ave., Akron, Ohio.
7. The B. F. Goodrich Company, Akron, Ohio.
8. Paramount Rubber Service, Inc., 1430 Rosedale St., Detroit, Mich.
9. The U. S. Stoneware Co., 60 E. 42nd St., New York City.
10. The American Foundry Equipment Co., 408 S. Byrkit Ave., Mishawaka, Ind.

#### GRINDING, POLISHING, BUFFING

New progress was made towards the satisfactory and economical polishing of objects with surfaces on several planes, such as circular or irregularly shaped pieces. A machine<sup>1</sup> for this purpose features a foot pedal control, leaving the operator's hands free, with automatic work holders and chucks and with automatic composition applicators. A novel development<sup>1</sup> has been that of a polishing and buffing machine which involves the use of a *slow speed wheel with loose abrasive* with the work chucked on a work holder and floated with cushioned pressure. This type



Airway ventilated buffs showing parts<sup>17</sup>.





*Pedestal type tilting tumbler.*

of machine is stated to effect marked reductions in wheel wear, abrasive used and labor of buffing or polishing.

Notable progress was made in designing *variable speed lathes*<sup>2 3 4 5 6</sup> for polishing and buffing. Most of the lathes announced have wide ranges of speed to maintain constant peripheral speed to insure constant buffing conditions and economical use of compositions.

One company<sup>2</sup> features a line of variable speed lathes both in small bench types and larger pedestal types with speed ranges from 1500 to 3000 r.p.m. Another company<sup>3</sup> features a heavy duty variable speed lathe with a spindle brake and variable speed from 1800 to 3600 r.p.m. One line<sup>4</sup> of lathes features long overhang with rapid change of speed possible from 870 to 3050 r.p.m.

Two types<sup>7 8</sup> of wide belt grinding and polishing machines were made for the polishing of stainless steel sheet. The machines feature easy

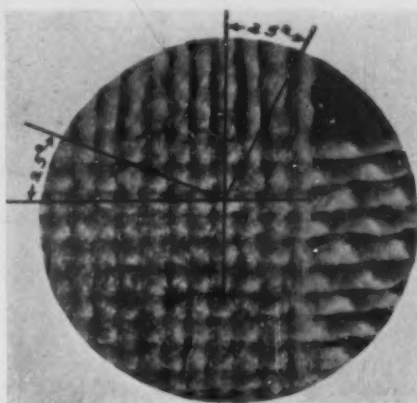


*Pedestal type tilting tumbler with separating boxes.*

removal of grinding belts and wide versatility.

Ingenious and novel developments in automatic polishing and buffing were numerous.

A new attachment<sup>9</sup> has been mar-



*Structure of chemically treated buffs<sup>3</sup>.*

keted for finishing of flat parts by grinding, polishing or buffing. Two attachments can be used on one lathe, thus effecting a marked saving in labor.

An automatic polishing and buffing

machine with 8 or more heads has been designed with wide versatility in applications to various objects. The machine features full floating spindles where the wheel rides gently over the contour of the work being finished<sup>10</sup>.

An *automatic composition applicator*<sup>11</sup> has been designed to apply composition automatically to the wheels of buffing lathes, semi-automatic and automatic buffing equipment. The applicator is operated by compressed air through a three-way valve timed to the conveyor of the buffing machine, and it handles composition bars from 2" sq. to 2" x 6".

A new rotary 5-work station machine<sup>12</sup> featuring a housed pedestal for motor drive and push button control was designed. Wide versatility is also claimed for this machine and automatic composition applicators are available for use with it.

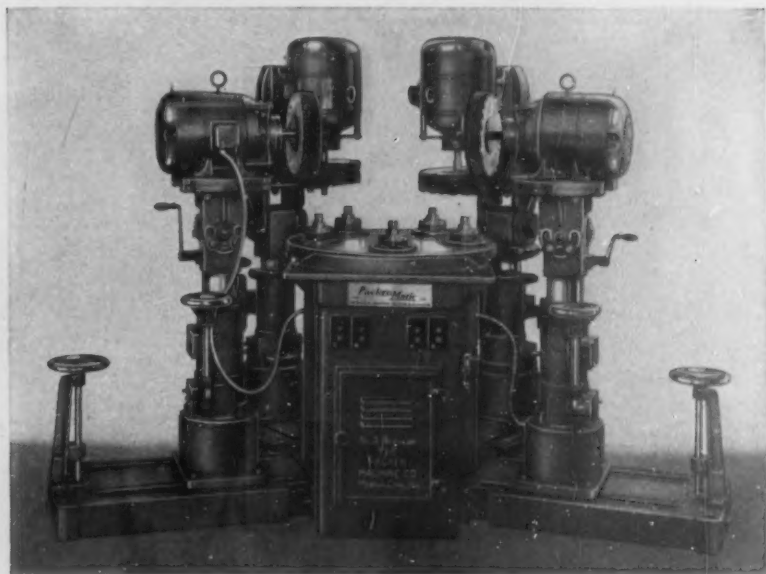
*Cold liquid glues* or cements for setting up polishing wheels were improved and a cement<sup>13</sup> for setting up wheels for polishing aluminum was developed.

Improvements in *face shields* for protection in grinding or polishing were many, one shield<sup>14</sup> featuring a combination of three shields in one, and another<sup>15</sup> was a light cellulose acetate clear vision shield.

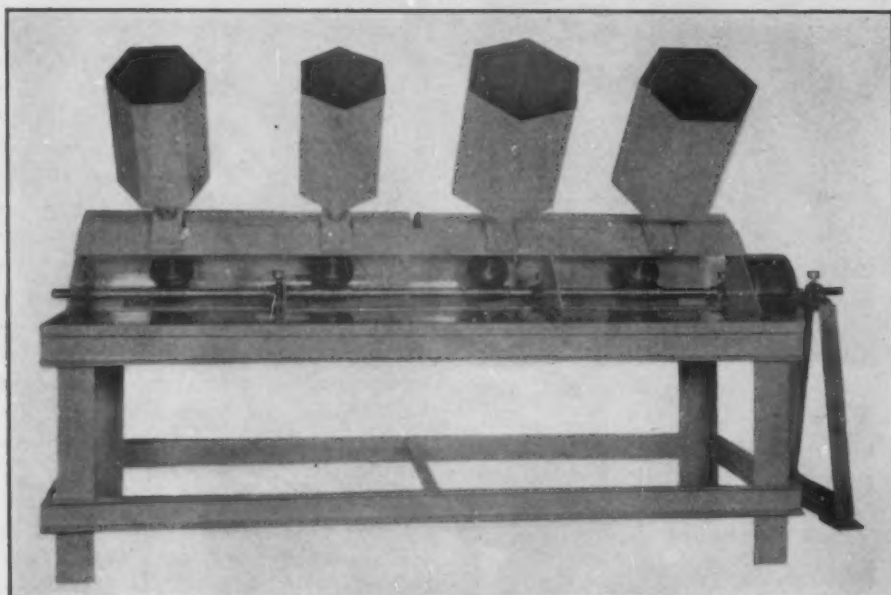
Improvements in *buffs* consisted of the use of *chemically treated buffs*<sup>3</sup> to increase wear resistance and to maintain the buffs moist; and a new *ventilating center*<sup>16</sup> for various types of conventional buffs. *Ventilated buffs*<sup>2 17</sup> found increased use espe-



*Automatic composition applicator<sup>11</sup>.*



*New 5 work-station automatic polishing and buffing machine.*



*Gang type oblique tumbling machine<sup>4</sup>.*

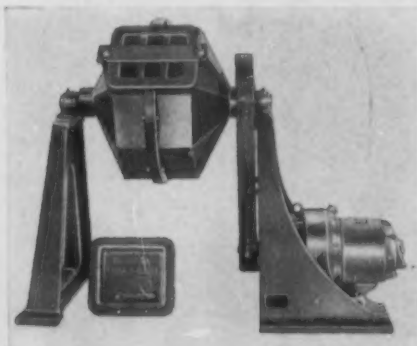
cially where burning may be encountered.

Bufs with *Sisalin sections*<sup>3</sup> were applied to the finishing of aluminum rods, tubing, etc.

New compositions<sup>18</sup> were developed for the buffing of high carbon and stainless steel and a buffing composition containing aluminum<sup>19</sup> was reported to prevent silicosis from inhalation of silica-containing composition dust. In addition, the aluminum is stated to markedly increase the ease of cleaning, due to the hydrogen gas developed by the interaction of the aluminum with the alkaline cleaner.

A new *greaseless composition*<sup>2</sup> for producing satin or Butler finish on all types of metals, including stainless steel, has been offered in a wide variety of grain sizes.

1. Industrial Equipment Div., Continental Roll & Steel Foundry Co., East Chicago, Ind.



*Triple action cutting barrel<sup>5</sup>.*

2. Chas. F. L'Hommedieu & Sons Co., 4521 Ogden Ave., Chicago, Ill.
3. Hanson-Van Winkle-Munning Company, Matawan, N. J.
4. Crown Rheostat & Supply Co., 1908 W. Maypole Ave., Chicago, Ill.
5. Hisey-Wolf Machine Co., Cincinnati, Ohio.
6. Rome Machinery Sales & Engineering Co., 627 Webster St., Rome, N. Y.
7. Excelsior Tool & Machine Co., Ridge Ave., E. St. Louis, Ill.
8. Mattison Machine Works, Rockford, Ill.
9. C. B. Larson, 27 Tuscan Rd., Maplewood, N. J.
10. The Udylyte Corp., Detroit, Mich.
11. Hammond Machinery Builders, Kalamazoo, Mich.
12. Packer Machine Co., Meriden, Conn.
13. J. J. Siefen Co., 5657 Lauderdale St., Detroit, Mich.
14. Boyer-Campbell Co., 6540 St. Antoine St., Detroit, Mich.
15. Willson Products, Inc., 267 Thorn St., Reading, Pa.



*Full vision face shield.<sup>14</sup>*

16. MacFarland Mfg. Co., Inc., 21-03—41st Ave., L. I. City, N. Y.
17. Jackson Buff Corp., 21-03—41st Ave., L. I. City, N. Y.
18. Harrison & Co., Box 695, Groveland, Mass.
19. Kocour Co., 4720 S. Christiana Ave., Chicago, Ill.

## BURNISHING AND TUMBLING

Several unique additions were made to the equipment for burnishing and tumbling. One *new tumbler*<sup>1</sup> designed, involves the use of a barrel 6" long and 20" in diameter, which can be used for ball burnishing and sand rolling. This type of barrel is available in a pedestal type tilting tumbler, and a leg type right-hand, single, oblique tilting tumbler<sup>1</sup>.

A pedestal type tilting tumbler<sup>1</sup> has also been designed with an *automatic electrical tilting device*. Tumblers of sturdier construction<sup>2</sup> have been made with arrangements for easy relining of the barrels.

A small unit<sup>3</sup> containing *midget plating and tumbling barrels* has been designed for the finishing of small batches of work. The unit is equipped with three speeds.

A *gang-type, oblique tumbling machine*<sup>4</sup> with four or more cylinders has been developed. The machine is driven by a worm gear drive and can be heated with an open gas flame, if heating of the solution is desired.

The manufacturer<sup>5</sup> of the *triple action cutting barrel* has designed through the year, a new smaller sized unit for cutting down, wet and dry grinding, tumbling, etc., for small batches of work.

Two manufacturers<sup>2</sup> have offered *new compounds* for barrel grinding of small steel or non-ferrous parts. These materials are said to result in a much smoother surface and more effective grinding, eliminating pitting such as is experienced with the use of sand.

1. The Baird Machine Co., Bridgeport, Conn.
2. Lupomatic Tumbling Machine Co., Inc., 4510 Bullard Ave., N. Y.
3. Chas. F. L'Hommedieu & Sons Co., 4521 Ogden Ave., Chicago, Ill.
4. Munning & Munning, Inc., 202 Emmett St., Newark, N. J.
5. Hartford Steel Ball Co., Box 146, Station A, Hartford, Conn.
6. Apothecaries Hall Co., Waterbury, Conn.



## PLATING SOLUTIONS

A need for a ductile, *semi-bright nickel* plating solution<sup>1</sup> was filled during the year. A solution was announced which has a low cobalt content, and can be used with current densities up as high as 75 amperes per sq. ft., to produce semi-bright nickel deposits, which are very ductile and easily buffed to a bright luster.

A *chromium plating* solution<sup>2</sup> was developed which is stated to give much better throwing power than the conventional bath, and has a whitish color resembling precious metals.

The cyanide *cadmium* solutions were improved<sup>3</sup> to increase their throwing power, brilliance and efficiency; and a new *bright dip* was marketed which is stated to produce a bright finish on cadmium with little loss in metal, and the resultant finish is claimed to resist corrosion and discoloration better than the undipped finish.

An outstanding achievement was that of a new deep *black molybdenum nickel* deposit<sup>3</sup>, which has good adherence on zinc and cadmium, although it can be applied to other metals, and which has exceptional throwing power, and good resistance to heat and abrasion.

A bath<sup>4</sup> was developed for applying antique or oxidized effects to metals. The bath produces a smut which is easily relieved, and after final finishing, hardens for lasting beauty.

A *brightener*<sup>5</sup> for almost all types of plating solutions, containing tan-

talum, was made available to the industry.

1. Hanson-Van Winkle-Munning Company, Matawan, N. J.
2. Triskalite Corp., 67 Wall St., N. Y.
3. E. I. duPont de Nemours & Co., Inc., Wilmington, Dela.
4. Special Chemicals Corp., 30 Irving Place, N. Y.
5. Linick, Green & Reed, Inc., Chicago, Ill.

## RACK COATINGS

There was much interest in rack coatings to insulate plating racks. Materials developed for this purpose include a fast-drying rack enamel<sup>1</sup>; a low viscosity fast-drying material for applying several coatings of material<sup>2</sup>, and a white rack coating<sup>3</sup>, which is force dried at 200° F., for about one hour, and ten coats are applied.

Another means for protecting racks, bus bars, etc., from corrosive agents and effecting electrical insulation is by a new synthetic thermoplastic resin in tape form<sup>4</sup>.

1. Maas & Waldstein Co., Newark, N. J.
2. Michigan Chrome Co., 6348 E. Jefferson Ave., Detroit, Mich.
3. United Chromium, Inc., 51 E. 42nd St., N. Y.
4. Hanson-Van Winkle-Munning Company, Matawan, N. J.

## ANODES

The improvements in anodes have been largely for chromium plating. A double or two-faced anode<sup>1</sup> with rectangular ribs on both sides for plating from two sides of the anode when a center anode rod is used, has been announced during the year. A single multi-edge anode with ribs on only one side is also available for use on side anode rods.

Another chromium plating anode<sup>2</sup> announced, embodies a lattice type construction of strip copper as a frame upon which is deposited and firmly bonded, a thin film of pure lead. This anode is stated to give the usual plating effects of a lead anode, with notably low electrical resistance.

Anode bags<sup>3</sup> with top and bottoms impregnated with a red resin to prevent disintegration at those points, was developed. The impregnation also prevents particles from working through the bottom of the bag.

1. Republic Lead Equipment Co., 7928 Jones Rd., Cleveland, Ohio.
2. Securus Lead Products Co., 6410 Detroit Ave., Cleveland, Ohio.
3. Hanson-Van Winkle-Munning Company, Matawan, N. J.

## FILTRATION

Wider use of filter aids for rapid filtration of solutions and of activated carbon for purification and control of bright plating solutions, took place.

A small universal filter<sup>1</sup> employing a packing of a filtering medium, such as pulp, charcoal, etc., was marketed. About 3/4 of a sq. ft. of filter area is available, and at 25 pounds pressure, the filtration rate of water is stated to be 300 gallons per hour.

Papers<sup>2, 3</sup> with high wet strengths for use on the canvas of filter presses to enable rapid cleaning, were announced.

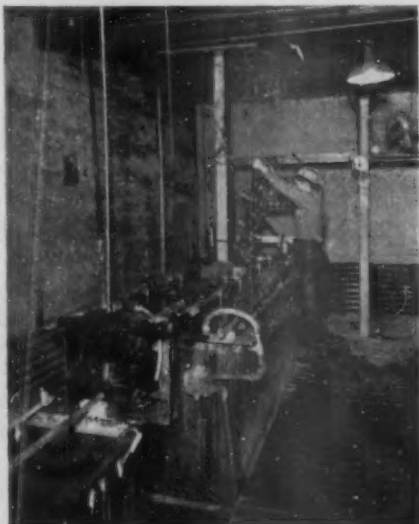
1. American Seitz Filter Corp., Paterson, N. J.
2. Hanson-Van Winkle-Munning Company, Matawan, N. J.
3. The Enthone Co., New Haven, Conn.

## PLATING EQUIPMENT

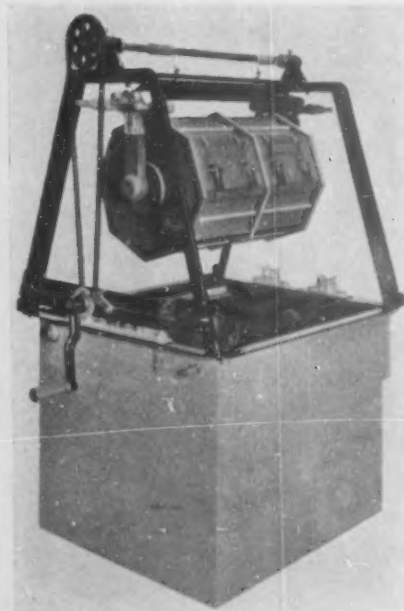
All of the leading manufacturers of plating equipment developed or modified their apparatus to fit special jobs as the occasion demanded.

A machine<sup>1</sup> was designed for the continuous plating of wire, such as musical strings, radio tube filaments, etc.

An improved gold plating unit<sup>1</sup>

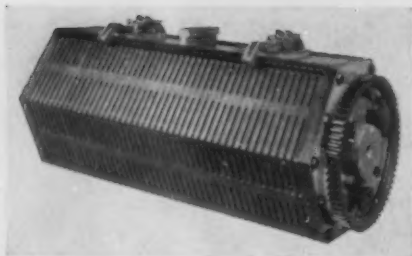


Rubber lined plating tank for bright nickel plating.



Hand operated hoist for plating barrel<sup>2</sup>.





*Laminated rubber plating cylinder<sup>4</sup>.*

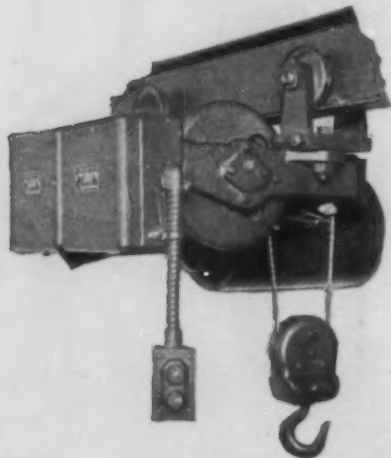
has been announced which features thermostatic control of the solution, which is contained in an insert tank, triple-porcelain lined and surrounded by a welded steel tank, housing the water bath.

An elevator type full-automatic conveyor<sup>2</sup> was perfected for a wide variety of operations, such as bright dipping, pickling, barrel plating and rinsing, lacquering, dipping, etc. The machine is of the dwell type with vertical lift and features wide versatility of operation and arrangement with low head room.

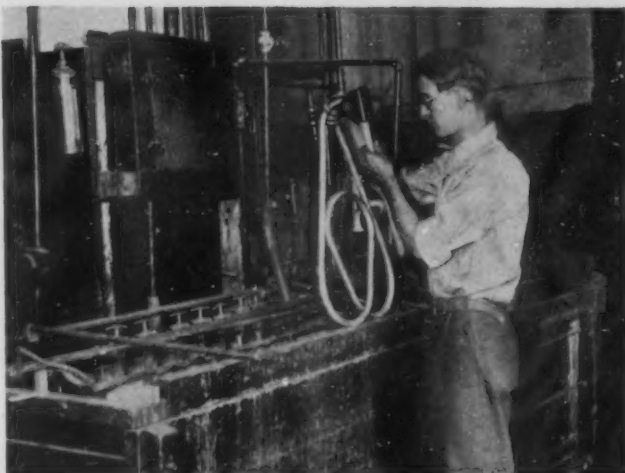
Immersion heaters<sup>3</sup> were announced for the electrical heating of all kinds of plating baths. The developments in barrel plating equipment included a laminated rubber plating cylinder<sup>4</sup> of sturdy construction with slot openings to allow greater flow of solution than round perforations and easier manual cleaning.

The removal of plating cylinders from the solution is facilitated by an improved hand-operated plating barrel hoist<sup>2</sup> which features a three to one ratio which involves approximately 15 turns to lift a 14" diameter barrel.

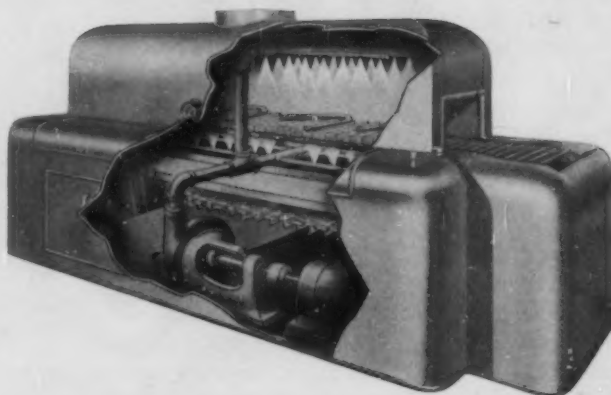
A brush or portable electroplating outfit<sup>5</sup> for plating nickel, copper,



*New electric lift.*



*Examining an immersion heater used for heating all types of plating solutions<sup>3</sup>.*



*New spray washing machine.*

brass and other metals from jelly-like solutions was announced.

The loss of valuable plating solutions from stuffing box drippage during pumping has been overcome by the design of a new series of corrosion resistant centrifugal pumps<sup>6</sup>, available in high silicon-iron alloys and stainless steels, provided with a uniquely designed impeller and stuffing box equipped with a lantern gland which permits the pump to operate against a closed discharge with a loose packing gland without drippage.

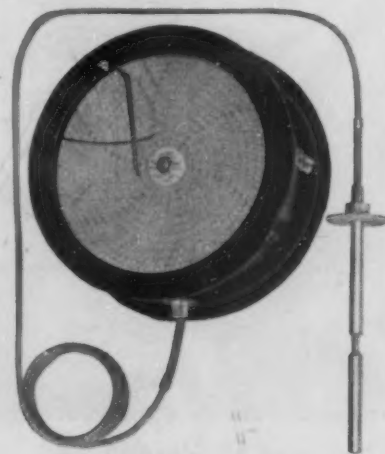
A hose type insulating steam joint<sup>2</sup>



*Method of plating typical articles<sup>5</sup>.*

has been made available which consists of a special reinforced rubber hose 8" long, built to stand 100 lbs. steam pressure, clamped to each end of the joint for attaching to standard size iron pipe.

1. Munning & Munning, Inc., 202 Emmett St., Newark, N. J.
2. Hanson - Van Winkle - Munning Co., Matawan, N. J.
3. General Electric Co., Schenectady, N. Y.



*Recording thermometer.*

4. Crown Rheostat & Supply Co., Chicago, Ill.
5. Rapid Electroplating Process, Inc., 1414 S. Wabash Ave., Chicago, Ill.
6. The Duriron Co., Inc., Dayton, Ohio.

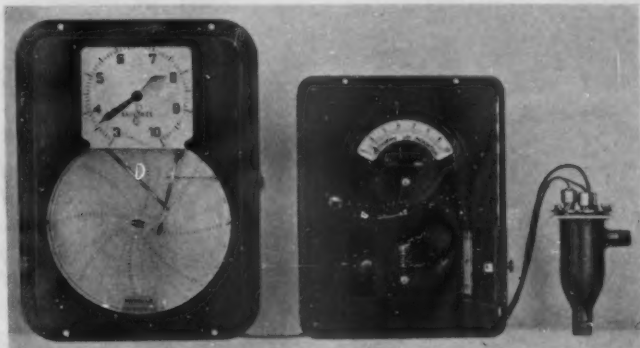
## CONTROL EQUIPMENT

The development and wider use of bright plating solutions and high speed plating solutions have rendered an impetus to the development and use of control instruments.

A new line of pH recording and controlling instruments<sup>1</sup> was announced which uses a glass electrode. Two types of electrode assemblies are offered; (1) the enclosed flow type, and (2) the immersion type.

The preparation of reference pH solution standards has been simplified by the sale of capsules<sup>2</sup> containing the proper amount of buffer salts to make solutions with definite pH values when dissolved in the proper amount of water.

The rate of flow of one fluid in



*pH recorder and controller<sup>1</sup>.*

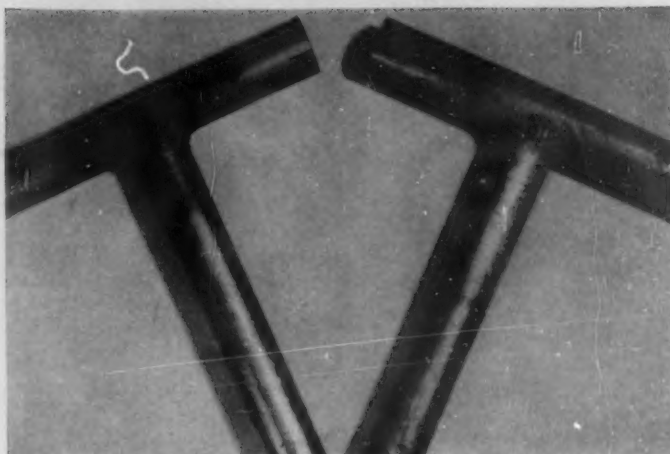
definite ratio to the flow of a second fluid can now be automatically controlled by a new flow ratio controller.<sup>1</sup>

A cooling water control<sup>3</sup> has been announced for control of water cooling for solvent recovery stills on degreasers.

Electroplating control using ampere-hour meters<sup>4</sup> has resulted in easier control of solution concentrations and plating thicknesses.

Numerous types of equipment were announced for the control of temperature. One instrument<sup>5</sup> featuring a recording of temperature from 0° F. to 1000° F., is activated by a spring-wound clock or synchronous motor. An immersion bulb is employed.

Another instrument<sup>6</sup> for temperatures up to 1000° F., functions by a no-contact electronic control giving instantaneous reaction and having no moving parts.



*Welded "T" joint.  
Left, uncoated.  
Right, zinc coated<sup>2</sup>.  
(Lower reference)*

Several improvements in optical pyrometers were announced. These include a new micro-optical pyrometer<sup>6</sup> for measuring the temperatures of very small objects, such as incandescent lamp filaments for laboratory or research work. With this instrument is furnished a direct-reading scale range from 600° C. to 3000° C. and higher.

taneous determination of "black body" and the "actual" temperature with scale ranges from 1700° F. to 3500° F.

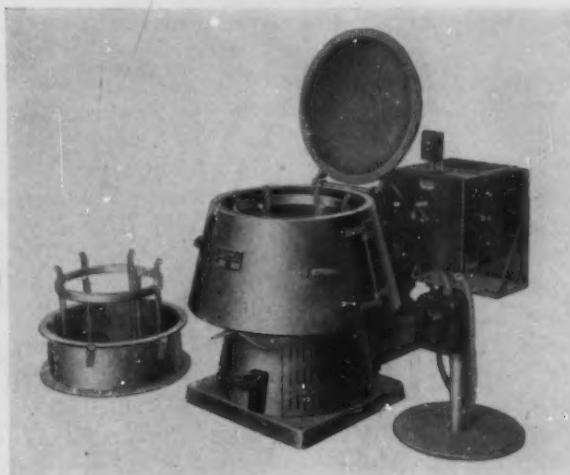
1. The Bristol Co., Waterbury, Conn.
2. R. P. Cargille, 118 Liberty St., N. Y.
3. Sarco Co., Inc., 183 Madison Ave., N. Y.
4. LaSalco, Inc., St. Louis, Mo.
5. Wheelco Instruments Co., 1929 S. Halsted St., Chicago, Ill.
6. Pyrometer Instrument Co., 103 Lafayette St., N. Y. City.

## HOT GALVANIZING

A patented form of zinc-ammonium-chloride<sup>1</sup> recommended both as a flux wash and in crystal form to make fusions on the molten zinc, has been reported during the year.

The coating with zinc of distorted or damaged metal, or repair of hot galvanized joints, has been made possible by a galvanizing powder<sup>2</sup> by which it is stated a continuous and protective surface comparable to original galvanizing can be obtained by applying the powdered material and then heating.

The securing of a smooth even finish on hot tinned or hot galvanized articles, such as bolts, stampings and general threaded parts has been facilitated by a centrifugal galvanizer<sup>3</sup>, which whirls the basket containing the parts coated with molten spelter, leaving an even layer of metal with a high finish.



*Centrifugal galvanizer for galvanizing small parts<sup>3</sup>.*

1. Hanson-Van Winkle-Munning Co., Matawan, N. J.
2. American Solder & Flux Co., Wayne Ave. & Berkeley St., Philadelphia, Pa.
3. Tolhurst Centrifugal Div., American Machine & Metals, Inc., 100-6th Ave., N. Y.

# A Review of Technical Development in

By Joseph B. Kushner, Ch. E.

Personalized Plating Service Co.,  
New York.

Another year has gone into electroplating history. Theoretical and practical developments have been many—new finishes for metals, new methods for testing and stripping, new applications of old techniques, these, and many more, first saw the light of day in 1939. All in all, the year past has been productive of growth and expansion in almost every branch of electrodeposition; it has seen renewed interest and intensification of effort in fundamental electroplating research and an increasing amount of production specification plating. Though the latter part of the year ushered in the second World War, thus perhaps, dimming the lamp of plating research abroad, here at least, we have gone forward with freedom and increased impetus in our electroplating evolution.

## Theoretical Developments

Eyring, Glasstone and Laidler<sup>1</sup> proposed a new and rather novel theory of *overvoltage* based on the idea of absolute reaction rates. They suggested, that in a water solution of an electrolyte, a layer of water molecules becomes attached to the cathode and a corresponding adjacent molecular layer of H<sub>2</sub>O becomes associated with the solvent. The slow process of transfer of a proton from the H<sub>2</sub>O layer attached to the solvent, to the water layer on the electrode accounts for the overvoltage.

Pioneering work was done by Graham, Read and Associates<sup>2</sup> in the field of *electrolyte films*. With a specially designed apparatus, they conducted a series of researches on cathodic films. Their work seems to show that our ideas of cathode films may have to be revised considerably and we may have to seek a new explanation for "burned deposits" to replace the one based on the conception that the high pH of the

cathode film at large current densities induces precipitation of basic material on the cathode.

The related role of *diffusion* in the electroplating processes was discussed by Burt-Gerrans<sup>3</sup>. He pointed out the fact that diffusion currents are invariably set up in an electroplating bath, the flow of the convection current being down from the anode where the electrolyte is richest in metal ions, and up the cathode where it is poorest in them. No matter how strong the agitation, these convection layers adjacent to the electrodes cannot be entirely removed. Donald Wood<sup>4</sup> in a paper on agitation gave expression to somewhat the same idea and pointed out that the main value in *agitation* is to diminish the effect of these convection currents, thus permitting higher current densities to be used in electrodeposition.

*Throwing power* was studied by several investigators. Gardam<sup>5</sup> examined the distribution of electroplated metals on a cup-shaped article. From his tests he computed ratios equivalent

to throwing power. He found cyanide copper to give the best distribution and chromium the worst.

Sacchi<sup>6</sup> determined the factors which influence the distribution of electrodeposited metals on a given object at various points on its surface and proposed a new, rather complicated formula for computing throwing power. The related problems of *current distribution* and the effects of anode size, shape and position on the same, were discussed from a theoretical standpoint by Kasper<sup>7, 8</sup> who gave some instructive examples with particular reference to chromium plating.

A comprehensive summary and original research on the effect of *complex cations in plating baths* was made by Mathers<sup>9</sup>. He pointed out the complexity of apparently simple electrolytes and showed, that in many instances, chlorides present in plating baths deposit at the cathode. He showed by reference to the literature that no one addition agent would work with every metal and that every metal "was a law unto itself." In a similar vein, Machu<sup>10</sup> examined the influence of colloids on the structure of electrodeposits. He concluded that colloids and substances of high molecular weight are adsorbed on the cathode during deposition forming a porous diaphragm with a "pin-cushion" structure. He believes that discharge of the cations on deposition of the metal takes place in the intermicellar spaces of this diaphragm. Since the pores are small, the crystal nuclei are small and numerous, thus giving rise to a fine grained deposit.

*Adhesion* of electrodeposits to their base metals was studied by Hother-sall<sup>11</sup>. His conclusions were that the forces of adhesion are atomic in na-



# Electroplating During The Year 1939

ture and that "anchorage" effects account only for a small part of the total adhesive effect.

*Reflectivity* of electroplated metals was investigated by Cinamon<sup>12</sup>. With a simple photoelectric apparatus, he determined the reflectivity of various deposited metals to varying wavelengths of light and found the following relative reflectivities, Al, 87; Rh, 85.6; Ni, 79; Cr, 77.

The *x-ray structure of electrodeposits* was discussed by Isenburger<sup>13</sup>.

Papers on *educational activities* appeared by Fulforth<sup>14</sup> and MacEwan<sup>15</sup>. Fulforth dealt with the educational activities of the American Electroplater's Society and MacEwan discussed the educational requirements for entering the electroplating field.

## Polishing, Degreasing and Cleaning

New methods of *semi-automatic polishing* were described by Bower<sup>16</sup>. Constructive *pre-plating methods* were taken up by Fulforth<sup>17</sup>. There were several interesting reviews on *solvent degreasing* by: Kroes<sup>18</sup>, who discussed the principles; Sacchi<sup>19</sup>, who considered simultaneous degreasing with cyanide and the deposition of a thin metal film such as copper; and Cleveland<sup>20</sup>, who described the latest developments in the field.

*Electrolytic cleaning* was made the subject of a progress report by Machu<sup>21</sup> who gave an extensive patent review with more than 39 references. *Alkali cleaning* and its effects on the plating industry were considered by L. C. Camel<sup>22</sup>. Rinker<sup>23</sup> took up cleaning before bright nickel.

## General Plating Practice

Todd<sup>24</sup> delivered a paper on the

*generator and rectifier* which described all the newest developments. The subject of *water in the plating room* was taken up in an original paper by Hogaboom<sup>25</sup>. This subject promises to become of great importance in the future as water is one of the only too often forgotten items in the plating room. Staining and poor work can often be traced to hard water.

*Dragout* came in for an increasing amount of attention. LoPresti<sup>26</sup> described various methods for overcoming dragout losses and pointed out the fact that lowering the surface tension of a nickel plating solution reduced the dragout. Conley<sup>27</sup> determined the dragout loss from a cleaning tank in an interesting practical way by comparing a tank in actual use with one containing the same volume of electrolyte not in use, taking full account of evaporation. Kushner<sup>28</sup> described a method for determining dragout losses by means of a rinse tank and hydrometer making use of the derived equation: Average dragout/piece =

$$\frac{VB_r (145 - B_t)}{n(B_t) (145 - B_r)} \text{ where } V \text{ is}$$

the volume of the rinse tank,  $B_r$  the Baume reading of the rinse after  $n$  rinses and  $B_t$  is the Baume reading of the plating tank.

*Fundamentals of electroplating practice* were written up by Pinner<sup>29</sup>. Young<sup>30</sup> contributed an article on *specification plating* giving weight tables for the electrodeposition of gold and brass. The subject of *scientific management* in the plating room was taken up by Haas<sup>31</sup> who pointed out ways and means for improving production and controlling it.

Hartshorn<sup>31a</sup> discussed *plating room layout*.

*Automatic plating* was the subject of a paper by Hogaboom<sup>32</sup>. He discussed the versatility of automatic plating equipment and the sequence of operations involved. Barrel finishing of metal parts came under a comprehensive study by Beaver<sup>33</sup> who discussed every angle of barrel burnishing and cleaning. Recent developments in the same subject were taken up by Barry<sup>34</sup>, who described the rolling and plating of steel.

McCheney<sup>35</sup> described the heating of plating baths with immersion heaters of a new type, using electricity as the heating source. Augsburger<sup>36</sup> pointed out the advantages of *external heating* by showing that siphoning losses are avoided, hot and cold areas in the tank are eliminated and productive capacity is increased.

*Electroplating practices abroad* came under the consideration of Stoddard<sup>37</sup> who described conditions and practices in the electroplating of automobile parts in the Soviet Union. Developments in *British practice* were described by Carter<sup>38</sup>. *French practice* was described by Ballay<sup>39</sup>.

*Purification and filtration* of electroplating solutions drew a great deal of attention during 1939. Smith<sup>40</sup> reviewed the standard methods for purifying and filtering plating solutions and gave metals and materials for pump construction. A comprehensive article on the same subject was written by Meyer<sup>41</sup> who discussed the advantages of the newer methods of filtration and the disadvantages of the older types. Faster filtering has been brought about by use of higher pressures and filter aids. A mechanical review of

the filtering apparatus was also given. Jevli<sup>42</sup> wrote a paper on *purification* of bright nickel solutions. Mattacotti<sup>43</sup>, discussed the same subject but broadened it somewhat, bringing out the effects of impurities in zinc, copper and silver solutions.

An instructive paper on purification of bright nickel baths was written by Weisberg<sup>44</sup>. He pointed out that, in general, organic contaminants could be removed by filtration with activated carbon or oxidation with permanganate. Certain of the heavy metals can be plated out.

*The economic aspects of bright metal plating*, were discussed by Witum<sup>45</sup>. *Recovery of gold and silver* from metal plating baths was discussed by Savage<sup>46</sup>. Gold is recovered by plating out in a recovery rinse tank equipped with carbon anodes and brass bagged cathodes. Silver is precipitated with zinc turnings.

A method for *preventing foaming in plating baths* was patented by Tucker<sup>47</sup>. A small portion of octyl alcohol added to baths containing the higher sulfonated alcohols inhibits foaming due to the presence of these wetting agents. As an aid in *reducing cyanide spotting*, Springer<sup>48</sup> recommended dipping plated work in a potassium acid tartrate solution for a period of 3 minutes to 16 hours depending on the class of work.

*Nickel eczema* was discussed by Mullschitsky<sup>50</sup> with reference to its aspects as an occupational disease.

The question of *racks versus wires* in plating was taken up by Kushner<sup>49</sup> who pointed out the great many advantages of racks over wires with particular reference to the gold plating industry.

### **Electroplated Metals and Finishes** *Aluminum*

A patent for *plating with aluminum* was taken out by Mathers and Blue<sup>51</sup>. The aluminum is deposited from an organic bath containing aluminum chloride and ethyl bromide or homologues. Another patent taken out on aluminum plating was that of Fischer<sup>52</sup> in which aluminum is deposited from a fused electrolyte at a temperature below which any substantial amount of alloy would be formed.

In the matter of *plating on alu-*

*minum*, there were several interesting developments. Travers<sup>53</sup> described the "Chrome-Alum" process to the Electrochemical Society. In this method, the aluminum is first oxidized then plated in a special bath. The same process was also described and discussed from commercial aspects by Yates<sup>54</sup> and West<sup>55</sup>. A patent for plating on aluminum was taken out by Ginsberg<sup>56</sup>. This patent describes a method for oxidizing the aluminum in a fused bath of oxidizing salts, dipping into an alkaline bath then finally immersing in the nickel plating bath. Another patent by Korpiun<sup>57</sup> states that aluminum can be plated by immersing it in a zincate solution containing caustic alkali and a univalent copper salt which forms an intermediate coating before regular deposition. Another patent by Frisch<sup>58</sup>



R. M. Goodsell

*Author of a paper on "Uses and Adaptations of Hard Chromium"*

deals with the use of manganese, zinc or cadmium sulfates in plating on aluminum.

### *Cadmium*

The *deposition of cadmium* from a thiosulfate solution was investigated by Gernes, Lorenz and Montillon<sup>59</sup>. They found cadmium deposits from this electrolyte contained about 5% sulphur. A patent on *cadmium plating* was issued to Camel<sup>60</sup>. Cadmium is deposited from an alkaline cyanide solution in the presence of sodium thiosulfate, silver or cobalt nitrate and tung oil or cod liver oil. Another patent on cadmium plating

was that granted to the Grasselli Chemical Co.<sup>61</sup> The electrolyte is a mixture of a cadmium containing compound and the reaction product of an alkali cyanide solution with an aldehyde or ketone other than  $\text{CH}_2\text{O}$ . The preferred types are paraldehyde, propionaldehyde, etc.

### *Chromium*

A series of researches was made by Russian investigators on the electrodeposition of *chromium*. Biryukov and Makar'eva<sup>62</sup> studied the effect of *temperature* on *chromium plating* from chromic acid solutions. They developed the Leibrich theory still further. The effect of *sulphuric acid* on the oxidation and reduction processes that occur in chromium plating were investigated by Biryukov and Melikhov<sup>63</sup>. Muller and Pietch<sup>64</sup> conducted researches on the effect of hydrogen peroxide in chromium plating baths. They found that formation of  $\text{Cr}_2\text{O}_3$  was at first proportional to the amount of  $\text{H}_2\text{O}_2$  added, but with increasing concentration of the lower chromium oxide, the amounts formed became less in proportion to the added peroxide. The peroxide itself did not affect the hardness or the brightness range.

*Hard chromium plating* was made the subject of a comprehensive discussion by Kramer<sup>65</sup>. He gave the following as his conclusions: The bright plating temperature range is between 35°-45°C. Decorative chromium plate can be deposited from a hard bath as the essential difference is in thickness only. Highest efficiency is obtained from a bath containing a  $\text{CrO}_3:\text{SO}_4$  ratio of 200:1 at a temperature of 30°C and a current density of 80 amperes per sq. ft. With a ratio of 40 to 1, the efficiency is the same as with the 100 to 1 ratio, at a lower current density. The plate is harder at higher current densities. Lead anodes are most suitable for plating purposes. The *application of hard chromium plating* was described by Goodsell<sup>66</sup>. *Chromium plating of dies and gauges* was the subject of a paper by Cotton<sup>67</sup>. He gave a comprehensive discussion on the practices involved in the refinishing of worn or improperly dimensioned dies and gauges. At the same meeting where this paper was given, Guerillot<sup>68</sup> described a plant in France where *chromium is plated*



on wire by an automatic machine. The machine is capable of handling thousands of feet of wire daily.

Ingersoll<sup>69</sup> discussed heavy chromium plating to a given thickness. He found the important factors to be: hardness of the surface to be plated; the difference in the coefficients of expansion of the base metal and the chromium deposit. He also described racks and the preparation of the work.

Temperature of chromium baths was a subject discussed by Gerhard<sup>70</sup>. He gave cost data and equipment necessary to maintain a uniform temperature in a typical commercial chromium plating installation.

The uses in mechanics of thick chromium plating were described by Gillet<sup>71</sup>. Chromium plating on zinc and its alloys was written upon by Schloetter<sup>72</sup>. His findings were that peeling of the chromium plate and formation of fissures and other irregularities, are due to the presence of free hydrogen which can be neutralized by the use of an undercoat of nickel or cobalt, or better still, by undercoating with zinc.

A patent on the electrodeposition of chromium was taken out by Bosch<sup>73</sup>. Metals are given a corrosion resisting finish by depositing chromium, polishing it and then depositing a second layer of chromium which is not polished. The second deposit is made brilliant by plating at an increased temperature.

A patent for plating on chromium alloys was issued to the Mond Nickel Co.<sup>74</sup> Chromium containing alloys to be plated are immersed in a hydrochloric acid solution and while still in the acid are plated with nickel from nickel chloride dissolved in the acid.

### Copper

Copper was deposited from a thio-sulfate solution by Gernes and co-workers<sup>59</sup>. Copper is deposited as a pure metal. The development of the new "High Speed Copper" plating process was discussed by Oplinger<sup>75</sup>, one of its developers. A complete study of the cyanide copper plating bath was made. The composition of the bath which gives practically 100% cathode efficiency was described, but the particular addition or wetting agents used, were not given.

Diev and Loshkarev<sup>76</sup> investigated

the deposition of copper from cuprous chloride solutions. Perfect cathode deposits were obtained from  $\text{Cu}_2\text{Cl}_2$  solutions in air and nitrogen atmospheres at current densities of 100-150 amps. per sq. meter. Even at 400 amps. per sq. meter, the deposits were satisfactory. In the absence of gelatin, the copper was deposited in coarse crystals but with gelatin present in quantities of about 0.5 to 1 gram per liter, fine, strongly adherent crystals of copper were produced. The cathode efficiency was 99% and better. The protection of the copper chloride surface with petrolatum or oil reduced losses due to oxidation of the cuprous chloride.

A copper plating bath designed particularly for protecting the silvering on mirrors was patented by



D. A. Cotton, E.E.

Author of a paper on "Hard Chromium Plating"

Schweig<sup>77</sup>. The bath contains copper salts, rochelle salts and either mono, di, or tri-ethanolamine or di-ethylenetriamine. NaOH, KOH or  $\text{NH}_4\text{OH}$  may be added. Another copper plating bath was patented by Stareck<sup>78</sup>, which consisted of an aqueous electrolyte containing the pyrophosphate radical and copper in the molecular ratio of 2 to 1 with a pH of 7.5-9.5.

A method for producing homogeneous and fast adhering coatings of copper on iron was patented by Radtke<sup>79</sup>. The iron is pickled in acid solution, plated with copper from a cyanide solution, then coppered in an acid bath, finally heated to 300°C.

### Gold

In the field of gold plating there were no developments of any importance. Wogrinz<sup>80</sup> gave the formulas for a number of standard gold plating baths. Oldam<sup>81</sup> described the finishing operations and gave several plating formulas for the finishing of solid gold articles. Weisberg<sup>82</sup> described a new semi-automatic installation for the finishing of costume jewelry.

### Indium

Little was published on this metal which aroused so much interest several years ago. A resume of indium plating was written by Kushner<sup>83</sup>, pointing out some of its possible fields of use.

### Iron

Iron plating came in for considerable attention with the revival of its use in electroforming, particularly in the interest of making dies and molds for plastics. A paper on *Electroforming With Iron* was published by Bishop, Orbaugh and Wallace<sup>84</sup>. They claimed several improvements in the process of iron plating which resulted in its successful application to the electroforming of molds, dies and replicas. Kushner<sup>85</sup> gave a comprehensive review of iron plating. Wein<sup>86</sup> described iron electroforming operations.

Plating on Stainless Steel was the subject of an article by Buss<sup>87</sup>. He found that the electrodeposition of metals on stainless steel offers the same difficulties as plating on chromium and passive nickel. Deposits do not adhere because of the oxide film. Good adherence was obtained by first pickling in hydrochloric acid solutions, then undercoating with iron or zinc plated from acid baths. An acid copper chloride bath gave good results also.

### Lead

A new electrolyte for the deposition of lead was the only item of interest in the lead plating field. Mathers and Forney<sup>88</sup> described the uses of lead sulfamate in lead plating. This salt, which is the reaction product of sulfamic acid and lead oxide, dissolves in water to form a conducting solution from which lead can be deposited. Smooth deposits are made possible by use of addition



agents such as aloin, resorcinol, etc. The acid is fairly cheap to use. Lead plating was discussed in a comprehensive review by Kushner<sup>99</sup>. Lead was co-plated with silver (see silver). Joshi and Rao<sup>90</sup> investigated the deposition of lead from alkaline solutions, studying the effects of current density, addition agents, etc. Cinnamon and Epstein<sup>98</sup> investigated deposition on lead antimony alloys.

### Manganese

The deposition of manganese from sulfate solutions was reported on by Yankelevich<sup>91</sup>. He obtained lustrous silver gray deposits. A patent on plating with manganese was taken out by Shelton<sup>92</sup>. Manganese is deposited from a sulfate solution, giving the manganese salts a treatment with an xanthate prior to plating to remove cobalt and nickel.

### Nickel

There was considerable research and investigation conducted in the field of nickel plating. The structure and properties of bright nickel deposits were studied by Hothersall and Gardam<sup>93</sup>. They investigated three types of deposits: those from nickel-cobalt alloy baths; those from baths containing naphthalene sulfonate (tri); those from baths containing sodium isopropyl naphthalene sulfonate. Their conclusions were: Ordinary nickel appears matte because of surface irregularities; bright deposits show no definite microstructure; porosity is about the same as that of matte nickel. They discovered parallel lines in nickel deposits on etching.

The theory and practice of nickel plating was discussed by Kochergin<sup>94</sup>. The action of inorganic colloids on the electrodeposition of nickel was investigated by Puri and Bhatia<sup>95</sup>. They found, that irrespective of the charge on the colloid, nickel ions formed a complex with the colloid which traveled to the cathode cataphoretically. The rate of hydrogen peroxide decomposition in nickel baths was determined by Greene<sup>96</sup>. He found that nickel hydroxide greatly accelerates the rate of the peroxide decomposition. An important paper was that of Wesley and Carey<sup>97</sup> which described work done on the deposition of nickel from nickel chloride solutions. They found

deposits from these solutions to be finer grained, harder but somewhat less ductile than those from the regular sulfate baths. Both types offer about the same protective values. The chloride bath reduces power consumption, is easy to control and has a lower susceptibility to pitting. It is more corrosive in nature, however.

A study of nickel anode corrosion was made by McFarlane<sup>98</sup> who found a minimum point on the curve plotted, with per cent loose nickel as ordinate and current density as abscissa. The effects of cadmium and arsenic in nickel baths were discussed by Witum<sup>99</sup>. Cadmium gives a brightening effect but is not as good as organic compounds. Young<sup>100</sup> de-



Dr. W. A. Wesley

Presented a valuable paper on "Deposition of Nickel from Chloride Solutions"

scribed the effect of wetting agents in nickel baths. A complex nickel ammonium sulfite electrolyte was patented by Rupp<sup>101</sup> for plating on zinc and zinc alloys.

A patent was issued to Ballay<sup>102</sup> on plating nickel from albumin addition agent baths. A patent was issued to Gardam<sup>103</sup> on nickel plating baths containing sulfonates plus gelatin, etc. A patent involving nickel and other metals was issued to the Eaton Mfg. Co.<sup>104</sup> in which the grain size of the metal plated is reduced below that at which pitting would tend to occur. Bright nickel plating was discussed in a comprehensive paper by Stocker<sup>105</sup>, which gave a complete resume of all accepted

practices and helpful procedures. Sterling<sup>106</sup> published a review on nickel plating from the practical standpoint. The nickel plating of zinc die castings was discussed by Thews<sup>107</sup>. Plating of nickel from thiosulfate solutions<sup>99</sup> brought an interesting new cathode reaction to light.

### Platinum Plating

A review on the subject was published by Kushner<sup>108</sup>.

### Silver

Thiosulfate as a substitute for cyanide in the silvering of copper surfaces was proposed by Yuzhnyi<sup>109</sup>. Bright silver was comprehensively discussed by Fischer<sup>110</sup> and the effect of a new type of addition agent (composition not given) on silver deposits from nitrate-cyanide baths was described. Silver plating for industrial applications was studied by Dornblatt, Lowe and Simon<sup>111</sup>. They found it possible to deposit thin (0.0001") pore free deposits of silver on specially prepared steel plated with 0.0005" of copper.

Porosity of electroplated silver was the subject of a study by Mathers and Gilbertson<sup>112</sup>. They found the porosity to be dependent on thickness of plate, roughness of base metal and method of application. A patent on the plating of zinc-silver alloys was granted to Menzel<sup>113</sup>. The electroplating of silver-lead alloys was investigated by Faust and Thomas<sup>114</sup> with the purpose of using such deposits as bearing alloys. Several such deposits were prepared. Silver plating of zinc alloys was discussed by Korpiun<sup>115</sup>.

### Tin

Several investigations of tin plating were carried out. Hothersall and Bradshaw<sup>116</sup> studied the ammonium oxalate type of bath and found it to be less satisfactory than the stannous sulfate bath. Alkaline tin plating baths were investigated by Heiman and Lucasse<sup>117</sup> and Baier and Angles<sup>118</sup>. Hothersall and Bradshaw<sup>118a</sup> experimented with the stannous sulfate baths. They found three types of additions necessary: (1) Cresolsulphonic acid to prevent oxidation, (2) A protective colloid, (3) A hydroxy compound such as

beta-naphthol. A comprehensive study and review on *electroplating* was published by Baier<sup>118b</sup>.

### Tungsten

Several patents were issued on *tungsten plating*. Armstrong and Menefee<sup>119</sup> received a patent for their method and process of depositing tungsten from a complex fluoride-phosphate-citrate bath containing an additional metal ion. Bauer<sup>120</sup> received a patent for a method of depositing tungsten from a bath containing a tungstate plus pyrophosphate plus potassium chloride, ferrocyanide, an alcohol and free caustic alkali.

### Zinc

*X-ray studies* of the structure of electrodeposited zinc were made by Usikov<sup>121</sup>. Several patents on *zinc plating* were granted to E. I. DuPont de Nemours<sup>122</sup>. One dealt with deposition of zinc from plating baths containing piperonal and compounds of that class plus protective colloids such as gelatin. Oplinger<sup>123</sup> patented a zinc electrolyte containing a soluble sulfide. Ferm and Hull<sup>124</sup> patented an *anode for zinc plating* containing a small amount of magnesium and (or) calcium. Camel<sup>125</sup> patented a solution containing zinc cyanide and a sulfite or hyposulfite. A German patent granted to Gorne and Perner<sup>126</sup> disclosed that lustrous deposits of zinc are obtained by electrolyzing alkaline zinc baths containing ortho, para, or meta phenylenediamine.

*Deposition of metals on zinc alloys* was studied by Wallbank<sup>127</sup>. The *finishing of zinc alloys* was described by Charleson<sup>128</sup> and Towner<sup>129</sup>. *Zinc plating* as a protective coating was investigated by Fischer<sup>130</sup>.

### Anodic Processes

#### Deposition of Non-Metallics

An interesting paper on the deposition of *synthetic resins* was published by Gemant<sup>131</sup>. He showed that it is possible to deposit many of the synthetic resins by dissolving them in organic solvents, stabilizing them with oils and passing an electric current at around 200-250 volts. A resume on the *anodic deposition of rubber* was written by Schaefer<sup>132</sup>. The *electrophoretic deposition* of substances such as aluminum oxide and barium carbonate was the sub-

ject of a paper by Boer, Hamaker and Verway<sup>133</sup>. They found it best to use suspensions in preference to colloidal solutions. *Lubricants deposited for copper wire drawing* were studied by Williams<sup>134</sup>. Soap solutions were used to deposit soap films on copper wire. The copper wire was anode and carbon rods were used as cathodes. At a sufficiently high voltage a pronounced decrease in the tension needed was noted.

Price and Thomas<sup>135</sup> investigated the anodic deposition of beryllia on silver for protection purposes. Some excellent results were obtained. Glazunov<sup>135a</sup> wrote on anodic deposition.

### Anodic Treatment of Light Metals

A comprehensive paper on *anodic coating of aluminum* was written by Edwards<sup>136</sup> who discussed the sub-



Phil Ritzenthaler

Author of an interesting paper on "The Effect of Temperature on Plated Coatings"

ject from every angle. The same subject was treated by the following authors: Smith<sup>137</sup>, Cuthbertson<sup>138</sup>, Neumann<sup>139</sup>, Keller and Wilcox<sup>140</sup>, Willstrop and Sutton<sup>141</sup> and patents were granted to Soll<sup>142</sup>, Edwards<sup>143</sup>, Rankin and Brossman<sup>144</sup> and Guthrie<sup>145</sup>. *Electrolytic surface treatment of magnesium* was taken up by Frasc<sup>146</sup> who stated that anodic oxidation of magnesium does not protect the magnesium from corrosion but that it makes an excellent paint base. A patent on *anodic treatment of magnesium* was granted to Elektron, Inc.<sup>147</sup>.

*Anodic oxidation of copper and brass* was discussed by Lyapunsova and Barashenokova<sup>148</sup> who found that a brass or copper anode could be covered by a thin layer of copper oxide by oxidizing in 15% sodium hydroxide.

*Anodic stripping of electroplated coatings* was reviewed by Werner<sup>149</sup>. Egeberg and Promisel<sup>150</sup> wrote on the *stripping and testing of zinc and cadmium deposits*. A new *stripping solution for tin coating* was proposed by Ritzenthaler and Doyle<sup>151</sup> consisting of ferric chloride, acetic acid and copper sulfate. A patent<sup>152</sup> was taken out on the stripping of deposits with solutions containing nitrates and reducing agents.

*Electrolytic brightening of nickel* is the subject of a patent granted to Hothersall and Priston<sup>153</sup>, making use of sulphuric acid of more than 60% concentration and surface tension reducing agents. *Electrolytic pickling of steel strip* was discussed by Neblett<sup>154</sup>. *Electrolytic polishing of steel* was discussed by Jacquet and Rocquet<sup>155</sup>. The electrolytic medium used is acetic anhydride plus perchloric acid. *Electrolytic brightening of nickel* is also the subject of a patent granted to Lindh<sup>156</sup>.

*Bright dips* were discussed by Meyer<sup>157</sup>. *Ferric sulfate as a pickling compound for copper alloys* was proposed by Loutrel<sup>158</sup>.

### Testing and Control

*Chemical methods of testing thickness of electrodeposits* were described by Clarke<sup>159</sup>. *Dropping tests for thickness of zinc and cadmium on steel* were investigated by Brenner<sup>160</sup> who made several interesting comparisons of available methods. Strausser<sup>161</sup> conducted researches on *porosity testing of nickel on steel*. *Porosity tests on tin on lead* were described by Baier and Hoar<sup>162</sup>. Beckwith<sup>163</sup> discussed methods of testing the *thickness of chromium deposits*.

A *method for determining adhesion of metal deposits* involving the use of a clever gadget was proposed by Mesle<sup>164</sup>. *Effect of temperature on plated coatings* was studied by Ritzenthaler<sup>165</sup>. The *ampere hour meter* as a control instrument was proposed by Daw<sup>166</sup>. *Current density characteristics* can now be tested by means of a plating tank invented by Hull<sup>167</sup>. *The value of the microscope*



to the plater was the subject of a series of articles by Egeberg and Promisel<sup>168</sup>. *Measurement of pH in alkaline solutions* was discussed by Thompson<sup>169</sup>. Hall and Hogaboom<sup>170</sup> wrote on measurement and control of pH.

#### Analysis

Determination of *formate and thiosulfate in silver plating baths* was described by Engel<sup>171</sup>. The *determination of tartrates* was discussed by Stoddard<sup>172</sup> who described a new method involving the use of nitrobenzene. The *formula and analysis of the cadmium complex* was the subject of a paper by Hall<sup>173</sup>. *Simple methods of plating solution analysis* were described by Oldham<sup>174</sup>. *Determination of total cyanide and ammonia in brass* was studied by Heiman and McNabb<sup>175</sup>. The *polorograph in plating* was the subject of an article by Sherrick<sup>176</sup> describing the possible uses of this powerful new instrument of analysis.

#### Metal Coloring

Hoffman and Hull<sup>177</sup> described a new *molybdenum black finish* which seems to possess excellent black coloring properties inasmuch as it gives a deeper, more lustrous finish than black nickel. Erskine<sup>178</sup> wrote on the *coloring of cadmium* and Harris<sup>179</sup> *methods for metal coloring*.

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# Surface Films in Metal Cleaning

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**The author discusses various types of films encountered in metal cleaning. These include films of mineral oils and greases, soap, fatty acids and solid particles. The information contained in this article should be helpful in evaluating and controlling cleaning efficiency.—Ed.**

In cleaning before electroplating, the plater is confronted with the removal of contaminating substances found present on metal articles. These oils and greases are derived from slushing and stamping oils, anti-rust materials and oils used during machine and threading operations. Other materials such as buffing and polishing compounds are frequently encountered.

These oily substances can be divided into two classes: (1) Animal and vegetable oils and fats, (2) Mineral oils and mineral base greases. The first class can be removed by saponifying and emulsifying in strong alkaline materials whereas the latter are removed by saponifying and emulsifying in alkaline solutions containing soaps or other wetting and detergent agents. As the complete removal of the last trace of these materials is essential, the plater is more often than not called on to remove films that are invisible.

As this article is principally concerned with the removal of water repellent films, a brief study of the nature of these films should be helpful.

Water breaks are generally caused by films of:

1. Mineral oils and greases
2. Soaps and fatty acids

## **Films of Mineral Oil and Greases**

In removing heavy accumulations

of oils and greases from metal surfaces, heavy duty alkaline solutions are commonly used. These soak cleaners are used to remove the greater portion of these oils and greases. Following the soak cleaner, the work is given an electrocleaning operation to remove the last trace



*E. C. Rinker*

of the oil or grease film. As this film is usually invisible, the plater, following a rinsing operation, holds his work in the air momentarily and looks for a water-break. If the metal surface is entirely free of a water-break, he is reasonably sure his work is clean and follows the rinsing op-

eration with an acid dip. Quite often, the water repellent film shows its presence following this acid dip.

The presence of a film of mineral oil or grease on the metal surface may be obscured if the rinse tank has become contaminated with cleaners containing soaps or other wetting agents. The rinse water may then wet the oily surface so that no water-break occurs. However, if the metal is then dipped into acid, a break will show up on the metal when it is withdrawn. By using a spray rinse, increasing the inflow of water or using a two tank system with counter current rinsing, this condition will overcome the tendency to disguise the oily film.

In cleaning cold rolled steel that has undergone severe drawing operations, the surface oils may be entirely removed, but when given an acid treatment, the work may show a decided water-break on the cold-worked area. This film is probably due to the acid treatment which etches the surface and releases oil that was sealed in during the drawing operation. This type of water repellent film should not be confused with the second type of film namely, a fatty acid film.

## **Films of Soap and Fatty Acids**

Electroplaters are familiar with soap films and take advantage of their water repellent properties in drying plated work and brass. This film is secured by dipping the cleaned or plated work in dilute soap solutions and immersing in hot water. The action that takes place is that the metal surfaces adsorb an extremely thin soap film which causes the hot water to drain off immediately, thus preventing water spots and stains. Although this film is desirable in this instance, its pres-



ence in most cases cannot be tolerated in preparing articles for electroplating.

Contamination of alkaline cleaners is the principle source of adsorbed soap films. The contamination is due to the saponification of fatty acids that are ingredients generally found in buffing and polishing compounds, and soaps and fatty acids that are mixed with mineral oils. Soap films form more readily on certain types of metals and alloys than others. Alloys of copper and zinc are particularly susceptible to a soap film when cleaned with direct current. This film will cause a water-break immediately after a rinse in cold water. It can be readily distinguished from other water repellent films because it cannot be removed by further cathodic treatment. In order to avoid the formation of this film, the work is given anodic treatment for a second or so in the electrocleaner immediately before coming out of the cleaning solution. A double throw switch is very useful for this purpose. Another way of removing the film is to immerse in an alkaline solution containing no soap.

As previously stated, copper and zinc alloys when electrocleaned adsorb a soap film more readily than other metals, whereas cold rolled steel does not adsorb this film. In cleaning cold rolled steel, cleaners containing soaps of abietic acid and other soaps are used because these materials add to the emulsifying qualities of the cleaner in effectively removing mineral oils and greases.

These soaps in themselves do not cause water repellent films, but due to the rinsing properties of these solutions, may cause the formation of a fatty acid film. The alkaline film contaminated with soap may not be completely rinsed off and when it comes in contact with an acid solution, the soap is converted to a fatty acid film causing a water-break following the acid treatment. The fatty acid film is frequently encountered in cleaning heavy gauge metals in automatic set-ups. The residual heat contained in the heavy articles dries the alkaline solution containing the soap contributing to poor rinsability. The fatty acid film is not particularly deleterious to good deposition when the articles are plated in cyanide plating baths because these solutions are sufficiently alkaline enough

to remove this film.

Water-breaks can be secured on metal surfaces without the presence of the above-mentioned films. Work that has been cleaned and plated will, after being rinsed in clear water and allowed to dry, show a water-break on immersion in cold water. This water-break is caused by an adsorbed film on the surface of the metal. Fine particles of dust and dirt will also cause water-breaks. The water in this case does not readily displace the air film around the individual dust particle.

The electroplater is confronted with other types of films that are not water repellent. These films may be visible or not, depending on their nature. This field is so broad that it cannot be completely covered in the scope of this article. However, since there has been considerable interest of late in the removal of polishing and buffing compounds and carbon smut, a few comments will be apropos.

In recent years, attempts have been made to remove these films from ferrous metals in one operation, namely the electrocleaner. More often than not, the use of high concentrations of the cleaning compounds, high current density with reverse or anodic treatment is recommended. The advantage of higher concentration of cleaning materials and high current densities are quite obvious but the use of reverse current may be challenged. Reverse current cleaning does show advantage in many instances. For example, every plater has through experience found that electrocleaners contaminated with non-ferrous metals such as copper, tin, lead and zinc will deposit loosely adherent smuts on metal when given long exposures to direct current. Similar deposits of iron can also be made. Iron may be introduced into the cleaner wherever a short circuit is made by having the electrodes touch each other causing a spark. This sparking introduces colloidal particles of iron which disperse in the solution and will deposit on the cathode.

Solid particles of emery, carborundum and small metal particles are held to the surface of the polished metal by the binding agent of the abrasive compound or lubricating medium. The composition, the proportion of lubricant mixed with the

abrasive and the size of the solid particles undoubtedly play an important part in the ease or difficulty of their removal in the electrocleaner. While the metallic particles are electrically charged there is no laboratory proof that the non-metallic particles possess electrical charges.

Assuming that the solid matter contains both charged and neutral particles, then the size of these particles is going to play a major part in removing them when using direct or reverse current. If the charged particles are larger, the force of gravity will overcome their tendency to migrate toward the cathode. If they are of colloidal dimensions, then there will be a tendency for them to adhere to the work. In this case, reverse current will offset this tendency.

The ease of removing non-metallic particles will depend somewhat on their size. The extremely fine particles that are in intimate contact with the metal will have a greater area of contact with respect to their weight than the larger particles and will be extremely difficult to remove. Films of this size are sometimes barely visible to the eye. Their presence can be determined by rubbing a wet cloth over a portion of the polished surface in a criss-cross manner and then follow with bright nickel plating. The bright nickel deposit will be brighter on the wiped portion than on the unwiped sections. This condition is more prevalent on highly polished work where the layer of grease is extremely thin and the solid matter is correspondingly finer in size.

The removal of oils and greases containing dirt and smut does not present as difficult a problem as a rule as polishing compounds. The reason is probably due to the fact that the smut and dirt are intermixed with the oils and are removed in the process of emulsification. An argument to support this reasoning is to try to remove the solid matter from the surface by electrocleaning after the work has been degreased in a chlorinated solvent.

Most platers agree that every cleaning job is an individual problem. The method of cleaning and the selection of the type of cleaning material to use must be worked out in the manner best suited for each particular plating department.



# Anodic Polishing of Metals

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Anodic polishing is essentially a dissolving or electrolytic pickling process and as mentioned in the cases of alloys is best suited for pure metals or alloys of homogeneous structures. At the present time this is a rather important limitation to its general applicability. Its industrial possibilities have already been acknowledged, as in the cases of copper and nickel. The high current densities used necessitate special care in racking, similar to that in modern chromium plating. It may reasonably be expected, however, that the metallographic uses of anodic polishing may be extended eventually to applications in the industrial fields.

Methods for anodic polishing of copper, brass, bronze, aluminum, iron and steel, tin, lead, nickel, zinc and cobalt. A mechanism for the anodic etching process is suggested.—Ed.

## Introduction

In the conventional methods for preparing metal specimens for microscopic examination, the surface of the metal is polished with abrasives of increasing fineness, for example, from rough emery paper at the start, to a suspension of fine alumina. The purpose of this procedure is to eliminate all surface imperfections and to obtain a surface which, upon subsequent etching, will reveal under the microscope the true crystalline structure of the metal, free of all lines or scratches. Besides necessitating a certain degree of skill on the part of the



Carl Schaefer

operator, this method is long and tedious. Far more important, it has been shown in numerous investigations that mechanical polishing produces a very thin, superficial, seemingly amorphous layer of metal (Beilby layer) quite different from the original metal and which may survive even the usual etching so that the structure finally seen may not be representative of the great body of metal below. Besides this amorphous layer, there exists a more

or less thick zone composed of microcrystals, having no resemblance to the normal crystals of the metal or alloy. The properties of such a surface are bound up with this special structure and are not specific to the alloy or metal itself. These dangers are especially great when polishing soft metals such as aluminum, lead, tin and their alloys.



Cast Chempur tin showing corrosion figures after electrolytic etching<sup>5</sup>. 142X.

P. A. Jacquet of France has done considerable work in an attempt to overcome these difficulties and has been successful in producing smooth, bright surfaces on several different kinds of metal. His method consists chiefly of smoothing the metal with several grades of fine emery paper, down to about the 0000 grade, cleaning, and treating the sample as an anode in an electrolytic bath of specified composition and under certain conditions of temperature and current density. The rougher the original surface, the more time will be required to complete the electrolytic polishing and to obtain a brilliant surface. Metal is removed anodically from the work which is finally rinsed, washed and dried.

Due to the relatively high current densities employed, some means of cooling the electrolyte must be afforded. This is best done by immersing the electrolytic cell in a bath of running water. A diagram of the apparatus used for electrolytic polishing is shown in Fig. 1. The operating procedure varies somewhat according to the metal being treated. In general, surfaces of remarkable smoothness and brilliance are obtained by this method which under the microscope show no evidence of polishing lines. After electrolytic polishing, the grain boundaries are scarcely visible, but they may be revealed by etching in the same solution at lower current densities. As an alternative, ordinary etching agents may be employed to show the crystalline structure of the polished surface.

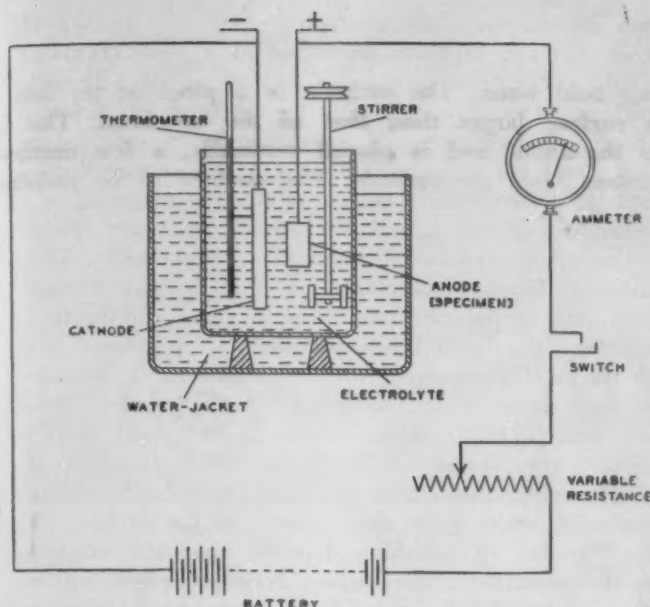


Fig. 1. Diagram of apparatus for electrolytic polishing and etching<sup>5</sup>.

The following is a list of electrolytes and operating conditions for polishing various metals and alloys, as developed by Jacquet and other investigators:

#### COPPER:<sup>1</sup>

##### Etching Solution

Orthophosphoric or Pyrophosphoric acid	400 to 500 gm./liter
Time	10 to 15 minutes
Temperature	15° to 25° C.
Current density	6 to 8 amps./sq. dm.
Voltage	1.5 to 1.8 volts

The potential difference should be such as does not quite cause bubbles to form on the anode. The current density required depends on the concentration of the solution and position of the anode. With 530 gm./liter of  $H_3PO_4$  and the anode vertical, 10 amps. per square dm. are required, while if the specimen is arranged horizontally with the cathode parallel to and above it, 6 amps. per sq. dm. suffice in about fifteen minutes. Preliminary polishing should be carried down to 00000 emery paper after which the specimen should be thoroughly cleaned before immersion in the polishing bath. The cathode is a strip of copper with an area slightly

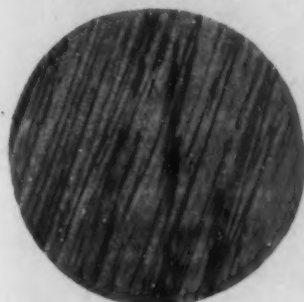


Fig. 2. Copper polished with 00000 emery paper. After 1000X.

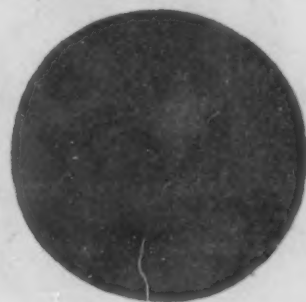


Fig. 3. Copper polished by electrolytic means. After Jacquet.

greater than the area to be polished. To obtain the best results, it is necessary to use filtered solutions and before switching on the current to eliminate any fine gas bubbles which sometimes appear on the metal surface when it is immersed. Fig. 2 shows the appearance of a copper surface under high magnification following a polish with 00000 emery paper. Fig. 3 shows the same surface after it had undergone the anodic treatment described above.

Subsequent etching may be carried out in the same solution by lowering the potential to about 0.5 volts and continuing the electrolysis at the reduced current density for about one minute.

#### ALPHA BRASS:<sup>2</sup> (70% copper—30% zinc):

##### Etching Solution

Orthophosphoric acid	430 gr./liter
Current density	13 to 15 amps./per sq. dm.
Voltage	1.9 volts

The same general operating conditions apply as with copper, yielding smooth, brilliant surfaces. Subsequent etching to emphasize crystal structure can be done in the same solution for a few seconds at 0.8 to 1.2 amps./sq. dm. If the alloy contains a large percentage of iron and lead, brilliant surfaces are not obtainable, probably because of a difference in the rate of attack of the electrolyte on the various constituents. In this case, a bath of 990 grams of  $H_3PO_4$  per liter operated at 2.5 to 3.0 amps./sq. dm. will eliminate scratches and reveal the structure.

#### ALPHA PLUS BETA BRASS (60% copper, 40% zinc):

With such heterogeneous alloys as this (e.g. Muntz metal), there are always two constituents present, excluding impurities, and with a differential in rates of attack, it is difficult to obtain bright surfaces. The bath found best for the purpose contains 530 gms. of  $H_3PO_4$  per liter and is operated at 1.9 volts and 9 to 11 amps./sq. dm. Etching is done for a few seconds at 1 amp./sq. dm.

#### BRONZE:

With bronzes, the difficulties encountered with the above-mentioned alloys are even greater. The best electrolyte is 990 gm. of  $H_3PO_4$  per liter using a small current density of 1 to 2 amps./sq. dm. The longer the electrolysis, the more pronounced will be the attack.

#### ALUMINUM:<sup>3</sup>

##### Etching Solution

Acetic anhydride	785 c.c.
Perchloric acid (d.-1.480)	215 "
Temperature	45° to 50° C.
Current density	3 to 5 amps./sq. dm.
Voltage	50 to 100 volts
Time	15 minutes

The electrolyte is prepared by pouring the acetic anhydride very slowly into the well-cooled perchloric acid. The specimen is completely immersed, vertically if a sheet, a few centimeters from the cathode, which is an



aluminum sheet. The temperature is kept between the described limits by cooling with running water and constant agitation is necessary. The electrolyte works best after it has dissolved 4 to 5 grams of aluminum per liter; anodic dissolution proceeds at the rate of about 0.004 mg. of aluminum per minute. After polishing is completed, the surface is washed in water, alcohol and finally with ether.

The grain boundaries are scarcely visible after electrolytic polishing but they may be revealed by a short electrolytic etch in the same solution at a current density of 0.2-0.8 amp./sq. dm.

This method of preparing specimens for examination is particularly adaptable for the softer metals which are liable to take up particles of abrasive and to show surface alteration due to flow. In aluminum of very high purity (99.998%), this surface layer will undergo recrystallization at room temperature.

#### IRON AND STEEL:<sup>4</sup>

##### *Etching Solution*

Acetic anhydride	765 c.c.
Perchloric acid (d.-1.61)	185 "
Distilled water	50 "
Temperature	below 30° C.
Current density	4 to 6 amps./sq. dm.
Voltage	about 50 volts

The bath is prepared as that for aluminum, the distilled water added last and the mixture allowed to stand for 24 hours before using. The cathode is an iron or aluminum plate, agitation is required and also a means of keeping the temperature below 30° C. With surfaces previously rubbed with 000 emery paper, polishing is effected in 4 to 5 minutes; if coarser emery is used, more time will be needed. The viscous reddish-brown layer that forms on the anode during electrolysis is removable by washing with water followed with alcohol. Almost all varieties of iron and steel, with wide range of carbon content and showing martensitic, sorbitic and pearlitic structures can be polished by this method. Some steels need slight modifications; nickel and nickel-chrome austenitic steels require at least 10 amps./sq. dm. or 6 amps./sq. dm. in a solution containing 665 c.c. of acetic anhydride and 335 c.c. of perchloric acid. The method is not applicable to malleable cast iron on account of the graphite. The structure of the sample is more clearly brought out by etching in the ordinary way.

#### TIN:<sup>5</sup>

##### *Etching Solution*

Perchloric acid (sp. gr. 1.61)	194 c.c.
Acetic anhydride (98%)	806 "
Temperature	20 to 30° C.
Current density	9 to 15 amps./sq. dm.
Voltage	25 to 40 volts

To make up this solution, the acetic anhydride is poured very slowly, a small quantity at a time, into the perchloric acid solution. In order to avoid rise in temperature during this operation, the vessel is cooled by running water.

For the polishing of specimens (total surface not to

exceed 10 sq. cm.), the electrolytic cell is a beaker of 250 or 500 c.c. capacity, immersed in a vessel containing cold water. The cathode is a piece of tin foil with a surface larger than that of the specimen. The latter is the anode and is placed vertically, a few centimeters distant from the cathode. The surface to be polished is placed in the moderately stirred solution at 15 to 22° C., the current switched on and the variable resistance (about 150 ohms) adjusted to the required current density. This adjustment becomes necessary in the course of electrolysis due to polarization effects and the rise in temperature of the bath. When polishing is completed, the anode is quickly removed without switching off the current and rinsed immediately in running water, then rinsed with distilled water, alcohol, ether and finally dried with compressed air. If the current is switched off before removing the anode, or if the latter is not rinsed immediately, white spots may appear on the surface.

The duration of polishing depends upon the original state of the surface; the surface becomes bright within a few minutes, but in order to remove irregularities, a longer period of electrolysis may be necessary. Stirring is necessary only if the time of polishing exceeds 8 or 10 minutes.

The solution may be used for a large number of operations; its color, which may deepen with time, has no influence on the quality of polishing. Measurements have shown that with a current density of 10 amps./sq. dm. the rate of dissolution of tin is 3 mg. per sq. cm. per minute (equivalent to a thickness of 0.005 mm.) It has been ascertained that the dissolution is in the form of bivalent ions.

Selective electrolytic etching to give a deeper etch and better defined crystal structure has been found to give best results in the following mixture:

Perchloric acid (sp. gr. 1.61)	50 c.c.
Glacial acetic acid	130 "
Voltage	15 volts
Current density	3 to 6 amps./sq. dm.
Time	100 to 200 seconds

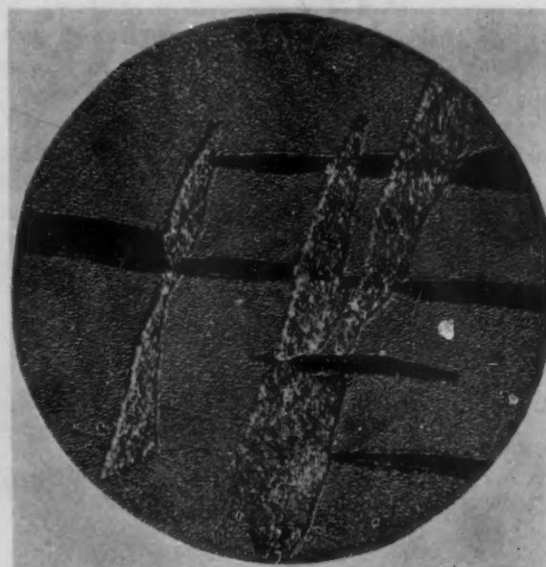


Fig. 4. High purity tin after electrolytic etching and polishing, showing twins across certain crystals<sup>5</sup>. 142X.



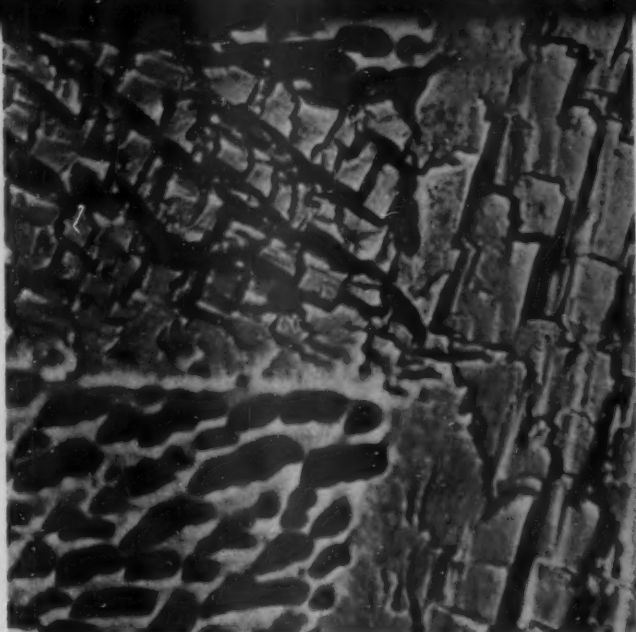


Fig. 5. Detail of one spot of Fig. 4. 1850X.

Operating conditions are essentially the same as in the polishing procedure except that cooling and stirring are not necessary and the specimen must be immersed with the current flowing, the variable resistance having been previously adjusted to give the proper current density.

A few photomicrographs of samples of tin electrolytically polished and etched are reproduced here and illustrate the fine quality of surface obtained by this method. Fig. 4 (142X) shows a section of high purity tin (99.9998%) with twins across certain crystals, revealed by corrosion figures different from those of the remainder of the crystal. Fig. 5 is at high magnification (1850X) showing details of one spot of Fig. 4 revealing the etched crystal facets. Fig. 6 (86X) is a section of Chempur tin, rolled down by 76% and electrolytically polished and etched. The direction of rolling was from right to left, the lattice showing the orientation of the rolling.

#### ZINC:<sup>6</sup>

##### Etching Solution

Potassium hydroxide .....	25%
Voltage .....	2 to 6 volts
Current density .....	16 amps./sq. dm.
Room Temperature	
Time .....	15 minutes

The specimen is made the anode in the above-described electrolyte which is agitated with a stream of air or nitrogen. A strip of copper serves as the cathode. Preliminary treatment involves abrasion with emery paper down to the 0000 grade followed by degreasing in benzene or other suitable solvent. When the electrodes are only 2.5 mm. apart, polishing occurs satisfactorily without evolution of gas at 2 to 5 volts pressure. At an electrode distance of 15 mm., about 1.5 to 3.0 volts give the same results. At lower or higher voltages, etching or roughening of the surface takes place with gas evolution, but at still higher pressures, satisfactory polishing with a full evolution of gas is again obtained. This phenomenon is explained below.

##### Etching Solution

Glacial acetic acid .....	650 to 750 c.c.
Perchloric acid (55° Be.) ..	250 to 350 "
Current density .....	20 to 25 amps./sq. dm.

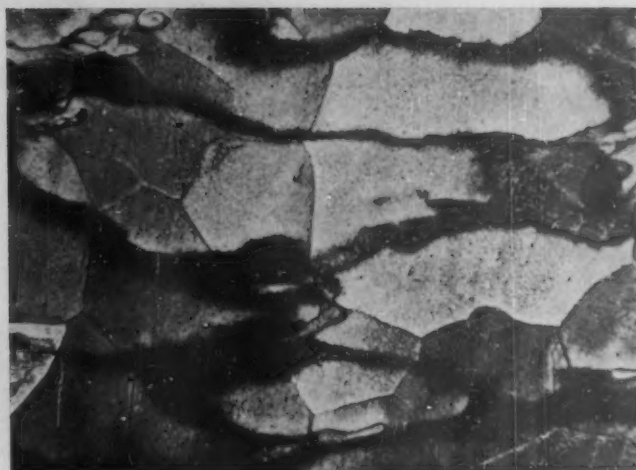


Fig. 6. Chempur tin rolled down by 76%; electrolytically polished and etched. 86X.

The sample is rubbed down to 0000 emery paper, washed in alcohol and immersed as the anode in a horizontal position in the above solution. The cathode is copper. After 1 or 2 minutes, the surface is covered with a brown film which is removed by rinsing in distilled water. After drying, the work is submitted again to electrolysis for 3 to 5 minutes, after which time the polishing lines have disappeared but the surface shows over-attack. The work is washed and dried again and, for the third time, placed in the electrolyte for only a few seconds until the surface becomes brilliant. At this point the current is switched off and the specimen quickly removed, washed and carefully dried to avoid oxidation.

A good etch is obtained in the same solution in a few seconds at 1 to 2 amps. per sq. dm. The entire process can be controlled by current density alone.

#### NICKEL:<sup>3</sup>

##### Etching Solution

	Range	Optimum
Sulphuric acid	45° to 62° Be.	55° Be.
Temperature	85° to 140° F.	100° to 125° F.
Voltage	8 to 10 volts	
Current density	280 to 560	
	amps./sq. foot	
Time	10 to 15 seconds	

The above conditions are used to anodically brighten dull surfaces of objects of nickel or having coatings of nickel produced by electroplating or other methods. It is claimed to be adaptable to mass production, the brightness being comparable to that obtained by buffing or burnishing. Since the amount of nickel dissolved from the various surfaces of the object is uniform, regardless of protruding edges and points, the dangers of cutting through these high spots which are encountered in conventional methods are obviated. Articles treated by this method can subsequently be rinsed in running water and transferred to a chromium plating solution. "Due to the uniform brightening of the nickel surface obtained by the process, a very good result may then be obtained, and the spots and uneven shades or the like of the chromium coating originating from irregularities in the brightness of the base metal are totally eliminated."

Lead cathodes can be used. At bath temperatures above 125° F. the process goes too fast, so that complete "unmetallization" may occur, whereas below 100° F. the brilliance of the surface becomes less satisfactory.

## COBALT:<sup>9</sup>

### *Etching Solution*

Orthophosphoric acid (sp. gr. = 1.35)  
Voltage ..... 1.2 volts

This solution was used by the investigators to polish cobalt specimens after preliminary mechanical polishing in their study of the magnetic structure of cobalt crystals, and followed the usual procedure of Jacquet. Lower voltages, or agitation at 1.2 volts produced an excellent macroscopic etch useful in determining crystal orientations. Somewhat higher voltages were found to cause passivity.

### *Mechanism of Electrolytic Polishing*

The phenomenon seems to be based on the passivation of the anode and is a function of concentration polarization. As the surface of the anode is dissolved, a thin, poorly conducting layer of liquid forms upon it. This layer is made up of a part of the electrolyte where the products of the anodic attack accumulate and is thicker in the hollows than over the projections. Hence the attack is greater on the projecting parts and continues until a smooth surface is finally obtained. The formation of insoluble products would hinder this action. In the polishing of copper, therefore, it can be seen that the failure of metaphosphoric acid ( $\text{HPO}_3$ ) to produce the desired results is due to the insolubility of  $\text{Cu}(\text{PO}_3)_2$  as compared with  $\text{Cu}_3(\text{PO}_4)_2$  or  $\text{Cu}_2\text{P}_2\text{O}_7$  in the acid solution. In addition, all the factors which favor diffusion of the products of the attack exert a definite rise in the minimum current density necessary for polishing. These factors are: lowering the concentration of the solution, increasing the temperature, and agitation. The importance of the position of the anode is probably associated with this diffusion phenomenon.

In the cases of copper and of zinc, two current density ranges have been found satisfactory. Jacquet's early experiments showed that a current density of 60 amps./sq. dm. at which there was a copious evolution of gas, gave good results. If this evolution was incomplete, however, and some gas bubbles adhered to the surface of the anode, numerous small spots in relief were obtained, producing a roughened surface. Later investigations proved that this danger could be avoided by using a current density just below that necessary to cause the first sign of gassing.

Contrast etching is achieved by removing layers of atoms from the various crystallographic planes of the crystals or grains, resulting in brilliant reflecting surfaces. These crystal faces or facets can be seen at high magnification (Fig. 5). The mechanism is similar to that of bright dipping as described by W. R. Meyer<sup>10</sup>, the anodic action being oxidizing in nature.

### *Application*

Comparative measurements of the brightness of me-

chanically and electrolytically polished surfaces have shown the reflectivity of the latter to be superior. Capdecorme and Jacquet<sup>11</sup> showed that the reflectivity of mechanically polished copper is 3 to 5% less than that of electrolytically polished specimens and more variable. After seventeen days preservation, the former's reflectivity decreased by 4 to 7% while the latter hardly at all.

The same investigator studied the reflectivity of similarly prepared specimens of pure aluminum<sup>12</sup> and found the reflecting power with anodic polishing remarkably constant at every point of the surface. Ultra pure aluminum surfaces, polished this way, have reproducible reflecting power and were suggested for use as optical standards.

The anodic method of polishing metals is particularly valuable in the study of electrodeposition. Jacquet<sup>13</sup> reports that when copper is deposited on the electrolytically polished surfaces of copper at low current densities (40 to 100 ma./sq. dm.) the metal is deposited along the boundaries of the crystal grain, but only on some of the grains themselves, others remaining unaffected (apparently these are grains whose crystallographic planes corresponding to the face of vertical growth are perpendicular to the general surface). The structure of such a deposit is identical with that underneath, as revealed by anodic attack, and shows crystalline continuity so complete that it is sometimes difficult to notice a line of demarcation between the two. In this case, true unity of crystals is obtained, probably with maximum adhesion. On mechanically polished surfaces, the first layers of deposited metal are made up of smaller crystals which gradually increase in size. The essential differences are capable of facilitating the study and interpretation of numerous phenomena in the electrodeposition of metals.

It is quite generally accepted today that the condition of the base metal has a marked influence on the corrosion resistance of the subsequent electrodeposit. A heavy deposit of nickel on a comparatively rough finish may not stand up as long as a thin deposit on a carefully prepared base metal surface. A method, then, which could economically yield bright, scratch-free and oxide-free surfaces conducive to the production of adherent, more corrosion resistant electrodeposits would find a warm reception in the metal finishing fields.

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METAL INDUSTRY, January, 1940



# A Suggested Basis for Specifications of Plated Coatings of Nickel and Chromium\*

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This paper has been reprinted to allow American readers to compare the English viewpoint regarding plating specifications with the U. S. viewpoint. Specifications covering the requirements for decorative or protective electrodeposited coatings of nickel and chromium on steel and on copper alloys with more than 50% copper are discussed. Methods for evaluating coatings are critically examined.—Ed.

The suggested basis for specifications for nickel and chromium coatings which is given in this paper originated in requests received by the British Non-Ferrous Metals Research Association from their members for assistance in framing their own detailed specifications. A suggested basis for such specifications was drawn up by the author (in collaboration with the Association) and after revision in the light of comments received from the industry was issued as a confidential report by the Association in March, 1938. The suggestions are reproduced by permission of the Association in this paper together with brief comments, particularly on the critical clause relating to thickness requirements.

## **The B.N.F.M.R.A. Suggestions for Specifications**

### **1. Scope.**

These specifications cover the requirements for decorative or protective electrodeposited coatings of nickel and chromium on steel and on copper alloys containing more than 50% of copper. The chromium must be deposited on an undercoating of nickel which conforms to the requirements laid down in these specifications and no metal may be deposited between this nickel coating and the base metal other than copper or an alloy of copper and tin (bronze). The use of chromium coatings to provide resistance against wear is not covered by these specifications, which also do not stipulate the methods to be adopted in the electroplating process and refer only to the quality of the deposits supplied.

\* Reprinted from Trans. Electrodepositors' Tech. Soc. pp. 195-204 (1939).

Articles must satisfy the requirements of these specifications when finished and ready for service.

Conditions of service vary considerably in severity and cannot be accurately defined but, as a general guide, three types of coating are covered:

A—for mild service (for example, in heated and ventilated buildings with periodical, non-abrasive cleaning of the surface).

AA—for general service (not recommended for continuous exposure to the weather).

AAA—for more severe service (for example, exposed to the action of rain or damp but with periodical, non-abrasive cleaning).

For special purposes, or where the conditions of service are exceptionally severe, more rigid requirements than are laid down in these specifications may have to be demanded.



*A. W. Hothersall, M.Sc.*

### **2. Finish and Appearance of Plated Surface.**

The appearance of the significant surfaces\* of the plated articles shall conform to that of a sample previously agreed upon by the manufacturer and the purchaser.

### **3. Freedom from Flaws.**

The significant surfaces of the article must be free from defects such as the following:

Blisters.

Surface marks or flaws due to imperfections in the base metal.

Pits.

Unplated areas.

Cloudy patches.†

Cracks visible to the naked eye.

Small uncovered areas of nickel

showing on articles called for in chromium plating.‡  
Nickel broken through by polishing, e.g., at edges of

\* "Significant surfaces" are defined as those surfaces which are visible and subjected to wear and/or corrosion. The designation of "significant surfaces" on any particular article shall be indicated by the purchaser on the drawings and/or by the supply of suitably marked samples.

† The complete prohibition of cloudy patches or small areas of nickel not covered with chromium may be unnecessary on certain articles and this clause may be modified in this respect by mutual agreement between manufacturer and purchaser.

holes or slots.  
Stains.  
"Spotting out."<sup>4</sup>

Certain of these defects (e.g., blisters and cracks) may be objectionable on any part of the article and may be so ruled by previous agreement between manufacturer and purchaser.

#### 4. Adhesion.

(Left blank pending the development of a satisfactory test applicable to various types and thicknesses of base metal and coating.)

#### 5. Porosity.

Deposits of quality AAA on iron and steel articles must not show more than six pores in any square foot of significant surface when submitted to the porosity test described in Appendix I. Articles of less than one-sixth square foot of surface area must show not more than one pore on the significant surfaces.

TABLE I.

Quality	Service Conditions (see Clause 1)	Minimum*	Thickness of Undercoating (inch)
		On Brass (Nickel)	On Steel (Nickel or Nickel-Copper-Nickel or Bronze-Nickel) †
A	Mild	0.0002	0.0004
AA	General	0.0004	0.0008
AAA	Severe	0.0006	0.0008‡

#### 6. Thickness of Nickel or Nickel-Copper Undercoating.

The thickness of deposit on significant surfaces must not be less than the values given in Table I. The test for thickness should be the B.N.F. Jet Test; the apparatus and solutions must be of the standardized type obtained

\* "Spotting out" is defined as the appearance of spots on plated or finished metals produced by exudation from pores in the metal of compounds absorbed from cleaning, pickling or plating solutions. "Spotting out" may not develop for some days or weeks after plating; the time required for development depends partly on the conditions of storage.

• The ratio of minimum to average thickness varies very considerably with the shape of the article and the conditions of plating and the average thickness required to be deposited may be several times that of the minimum thickness specified. As it is impossible in a single specification to cater for various types of article, the values given in Table I have been chosen to apply where average thickness of approximately twice the stated minima will have to be deposited to meet the specifications. On articles of fairly regular shape, average thicknesses of less than twice the stated minima will be required to meet the specifications and higher minimum values, up to 50% in excess of those given in Table I, may then be specified.

† As a guide to manufacturers, it is pointed out that, in the plating of steel with deposit of quality AAA, the requirement of the porosity test (see Clause 5) may best be met by depositing a composite coating of nickel-copper-nickel or of bronze-nickel, the copper or bronze deposit being buffed before application of the final nickel deposit. The use of a composite deposit under chromium must, however, receive the prior agreement of the purchaser.

‡ If a composite deposit is applied, the minimum thickness of the final nickel deposit shall be 0.0004" (see note•).

from authorized suppliers and the test must be carried out in accordance with the directions supplied with the apparatus. The minimum number of Jet Tests to be made on any one article will vary with its size and shape and shall be subject to mutual agreement between manufacturer and purchaser. Any other recognized test for minimum thickness which is clearly specified may be used with prior agreement between purchaser and manufacturer.

#### 7. Thickness of Chromium Coating.

The average thickness of the final chromium deposit shall not be less than 0.00002" for qualities A and AA, and 0.00004" for quality AAA. The thickness of chromium may be measured by chemical analysis or by the method given in Appendix II. (This clause must be regarded as tentative pending further tests.)

#### 8. Sampling and Rejection.

Methods of sampling and re-sampling and the basis of rejection shall be subject to mutual agreement by the manufacturer and purchaser, since the number of samples to be selected and the frequency of selection will depend upon the type and the number of pieces to be plated.

### Appendix I

#### Porosity Test for Chromium Plated Iron and Steel.

1. The specimen is degreased, first with an organic solvent and then by rubbing with a soft cloth or pad of cotton wool moistened with a paste of magnesium oxide and water. There must be no sign of "water-break" on the surface to be tested after degreasing.

2. A piece of paper§ of about the same size as the area to be tested is spread upon a sheet of glass and is made uniformly damp by brushing it with the solution given below (freshly prepared). The paper should not be made so wet that liquid will drip from it when it is allowed to hang vertically or the blue spots will be diffused. The damp paper is brushed into close contact with the surface with a brush which has been made slightly damp with the reagent. The paper is allowed to remain in contact with the surface for 10 minutes; if it shows any tendency to dry or to separate from the metal surface, it should be brushed with a brush made slightly damp with distilled water. After completion of the test, the paper is removed, well washed to remove soluble salts and suspended in the air until dry. The number of pores in the area tested is indicated by the number of blue spots on the paper.

3. The ferricyanide reagent has the following composition:

Potassium ferricyanide	10 gm.
Sodium chloride	5 "
Distilled water	1 liter

§ Since transference of the blue corrosion product from the pores to the paper depends on securing satisfactory contact between the paper and the surface to be tested, the paper used should have a smooth surface and be of fine texture. It should also be sufficiently thin to adapt itself as far as possible to the surface tested and strong enough when damp to resist rupture during the brushing treatment.



## Appendix II

### Thickness Test for Chromium Coatings.

The surface of the sample is well rubbed with a soft cloth or pad of cotton wool moistened with a paste of magnesium oxide and water and then rinsed in water; there should be no "water-break." Obvious grease is preferably first removed with organic solvent.

The sample is then dipped into concentrated hydrochloric acid (sp. gr. 1.16) containing 20 g. per liter of antimony trioxide.

The time is measured with a stop-watch from the point at which the surface darkens and gassing starts until gas evolution practically ceases.

The thickness of chromium is given by dividing this time by the time required for solution of a unit thickness at the temperature of testing (obtained from a calibration curve).||

When the sample is large in size, a portion of the surface, the position and area of which shall be agreed upon by the manufacturer and purchaser, may be tested<sup>‡</sup>, either (1) by partly immersing the specimen in the solution, (2) by stopping off the remaining surface with a material such as nitrocellulose lacquer or chlorinated rubber solution, or (3) by applying the solution in a glass ring fixed in contact with the surface with a plasticine joint.

### Explanatory Notes

#### Clause 1. Scope.

It will be noted that the BNF proposals are confined to decorative coatings of nickel and chromium on brass and steel. Insufficient information was available at the time of drafting to enable suggestions to be made for coatings on other base metals, such as aluminum and zinc alloys. No attempt has been made to cater for special conditions, such as where complete immunity from corrosion is required. More rigid requirements may have to be demanded in such conditions, depending on the severity of the corrosive influences and on whether periodical cleaning of the surface is envisaged.

#### Clause 4. Adhesion.

Investigation of methods of testing adhesion is in progress with the object of developing a test suitable for use in inspection. This investigation is well advanced and there appears to be a good prospect of a suitable method becoming available in the near future.

#### Clauses 5 and 6. Porosity and Thickness of Nickel Undercoat.

*General.* The protective value of electroplated coatings of nickel and chromium has been shown to be intimately connected with the thickness and freedom of the nickel undercoating from discontinuities, i.e., from pores or pinholes. The relationship between porosity and protective value is, however, by no means simple since it de-

pends not only on the number of pinholes per unit area but also on their local concentration, their size in relation to the thickness of the coating and on the conditions to which the article is exposed in use. It is now well established, however, that there is an approximate relationship between the porosity and thickness of nickel coatings<sup>1</sup> and, since thickness can now be determined quantitatively, and expressed numerically, it is a more useful criterion on which to assess protective value in inspection. Furthermore, it is known that, if very thin nickel coatings could be produced without discontinuities, they would only protect the base metal effectively for a limited period owing to the liability of mechanical damage and attack on the nickel<sup>2, 3</sup>. A suitable minimum thickness of nickel is therefore important, irrespective of porosity. Where severe conditions of use have to be withstood, however, it may be insufficient to specify only a certain minimum thickness of nickel because of the variable quality of the base metal encountered in practice. Thus, while nickel coatings at 0.001" thickness are usually substantially free and at 0.0015" thickness often entirely free from pinholes on steel of average quality, there may be, with steel of poor surface quality, a sufficient number of pinholes at these thicknesses to give objectionable corrosion.

For coatings of the best quality, which are to be used under fairly severe conditions, it therefore appears desirable to inspect by a porosity test as well as by a thickness test.

#### Clause 5. Porosity.

The recommended inspection test for porosity is the ferricyanide test. The salt-spray test, which is sometimes used for inspection purposes, has been shown by Strausser, Brenner and Blum<sup>4</sup> to have certain important drawbacks, for example:—(a) When used as a porosity test, it must, if reliable results are to be obtained, be operated for a considerable time (of the order of 100 hours). When thus used, it showed no advantages over the ferricyanide test, which gives a result in 10 minutes which can be kept for reference. (b) When used to indicate the first well-defined appearance of rust, considerable differences in behavior of coatings of similar porosity were found. Thus, some deposits 0.002" in thickness showed slight rust after only 6 hours spraying, although the porosity shown by the ferricyanide or prolonged salt-spray tests was very small. Other similar coatings did not develop rust until after 50—100 hours spraying. The effect of temperature was marked during the early stages of the test, a similar amount of corrosion being found after 24 hours at 35° C. as after 48 hours at 22° C.

Difficulties undoubtedly arise in specifying the basis of rejection with the ferricyanide test and it is now considered that some revision of the requirements laid down in clause 5 is necessary.

(1) See for example "Chromium Plating"; Bauer, Arndt and Krause; London, Edward Arnold & Co., 1935; p. 128.

(2) S. G. Clarke, "The Atmospheric Corrosion Resistance and Protective Value of Metallic Coatings." J. Electrodepos. Tech. Soc., (1939), preprint.

(3) A. W. Hothersall and R. A. F. Hammond. Trans. Electrochem. Soc., 73, 449, (1938).

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|| Note by author: A calibration curve has now been published—see S. G. Clarke, J. Electrodepos. Tech. Soc., 1938, 14, 26.

‡ When the area tested is limited, the result obtained no longer represents the average thickness and some reduction of the thickness specified may then be desirable. This question is being further considered.

#### Clause 6. Thickness.

(a) *Method of Test.* Methods of testing local thickness which are suitable for plant control are not necessarily useful for general specification testing, for which it is essential that the results should be reasonably independent of the conditions of deposition. To be suitable for inspection testing, a method should be capable of local application. The determination of average thickness of nickel coatings is only practicable with fairly small articles; it is not only a relatively lengthy process and difficult to carry out without trained personnel but the result obtained gives less useful information on the probable protective value of the coating than that of a local thickness test. A local thickness test should be rapid, economical and non-destructive; it should be generally recognized as giving reliable results and should preferably be standardized so as to be capable of giving sufficiently accurate results when operated by untrained personnel.

The BNF Jet Test<sup>5</sup> (developed in response to a request from the Electrodepositors' Technical Society) appears to meet these requirements satisfactorily. Microscopic measurement of sections, while attractive in allowing the deposit to be seen, is not only slow and destructive, but it is not as free from the possibility of error as seems to be generally imagined; careful standardization is essential if reliable results are to be obtained. The magnetic methods are attractive on the grounds of rapidity and are likely to be specially useful for plant control, but more experience of their reliability is required, especially with various types of nickel deposit, before they can be accepted for general specification use. The necessity of heat-treating the deposit before applying the test, indicated by Brenner as being necessary to convert the nickel deposit to a standard degree of magnetic permeability, would seem to be a drawback to the use of the test in general inspection; composite coatings (e.g. nickel-copper-nickel) would also appear to present difficulties.

The exact method of inspection and the basis of rejection needs to be more clearly defined than has been done in clause 6. A suggested method is as follows:—Articles should be tested for thickness of coating at any desired number of places by an approved local thickness test; an article should be rejected if the thickness of coating is less than the values given in the table in two separate tests not less than one half of an inch apart. Thus, if the BNF Jet Test were used, the solution would be run for a time corresponding to the values given in the table at any desired number of spots and if the coating were perforated at two spots more than half an inch apart, the article would be rejected.

(b) *Numerical values.* The numerical values given in the table in clause 6 were chosen as a practical compromise after careful consideration of the complicated factors involved, viz.: (i) inequalities in the distribution of thickness on any given article; (ii) variations in average thickness between different articles plated together, due to the position in the tank or on the rack, and also between batches plated at different times. It should be noted that the values specified in clause 6 are minimum thicknesses at any given point on significant surfaces and

not the averages of a number of determinations.

Some indication of the variability in distribution of thickness is given in the footnote to clause 6. On some articles, such as radiator shells or bumper bars, fairly uniform distribution may be secured and it may not be necessary to plate an average thickness more than about 50 per cent in excess of the minimum specified. For such articles, an increase in the minimum values given in the table for AAA quality deposits to 0.0009" (brass) and 0.0012" (steel) might be advisable. On the other hand, articles of more complicated shape might require an average thickness of two to three times the minimum to pass the specification.

Where an average thickness in excess of these amounts is needed, it would generally be impracticable to apply a specification and re-design of the article is indicated. For some purposes, however, an ingenious device, suggested by the author's colleague, Mr. G. E. Gardam, may be employed to minimize the difficulty, without seriously reducing the value of the specification. By re-defining the surfaces on which thickness tests may be made as those surfaces which can be touched by a ball of a given diameter, areas on which the thickness is likely to be specially small, such as angles or curves of small radius, are eliminated; a suitable diameter of ball would probably be about 0.75". Manufacturers and users should, however, clearly recognize that the presence of areas which cannot be touched by such a ball implies defective design from the plating point of view.

The same minimum thickness of nickel on steel is suggested for qualities AA and AAA (0.0008") but quality AAA is required to withstand in addition a porosity test. Deposits of AA quality would vary in porosity according to the quality of the surface of the steel but to produce the AAA quality, the plater would be obliged to ensure that the steel was of good quality or to apply a greater thickness of nickel.

The specification of a greater minimum thickness of nickel on brass than on a copper undercoating for an AAA quality deposit may at first sight appear inconsistent. The reason for the suggestion is that a lower thickness of nickel would generally be required to give freedom from porosity on an electrodeposited copper surface than on brass.

#### Clause 7. Thickness of Chromium.

No satisfactory inspection method for local thickness testing of chromium coatings appears to be available. Knowledge of the local thickness of chromium is, however, of less importance than of nickel and the specification of an average thickness is considered to be satisfactory for ordinary purposes.

Final decision on the thickness of chromium to be specified has not yet been reached. It is believed to be general practice to apply average thicknesses of the order of 0.00002" but the distribution is likely to be more irregular than with nickel. Since it would appear to be necessary to limit the area of surface tested with large objects, it may be advisable to specify an alternative of average thickness over a definite area, localized as indicated in Appendix II. This matter is under consideration. The thicknesses specified in clause 7 are intended to be average values over the whole of the significant surface.

<sup>(5)</sup> S. G. Clarke, J. Electrodepos. Tech. Soc. 12, 1 and 157 (1937); Preprint, (1939).



# SHOP PROBLEMS

## Technical Advisors For January Issue

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When sending solutions for analysis please give following information: name and address; class of work being plated; kind of solution and volume; length, width and depth of tank; temperature of solution; current density, cleaning sequence and any other pertinent facts.

### The Use of Glue for Polishing Wheels

Q. I would like to secure answers to the following problems: (1) We have two full-neck leather wheels which fail to soften after the usual treatment with neatsfoot oil, so that the wheels cannot be used. Is there some way I can treat these wheels so that they can be used as grease wheels for brass? (2) I would like to know the proper way to mix glue and the amount of water to use, how long to soak and at what temperature to keep it. I have also had some trouble with grease wheels drying out and the surface cracking. Is there any way to overcome this difficulty, and also is there anything that can be added to glue to prevent its drying out?

A. If the glue is ground, the proper way to prepare it is to stir the ground glue into cold water; let it soak one hour, then heat to a temperature of about 150° F. until thoroughly dissolved. This generally requires about 20 minutes to a half hour. Then turn off the steam and let the solution stand quietly for a few minutes to allow the air, that has been incorporated with the cooking, to escape.

In rooms with normal temperatures of around 70°, glue should be applied at about 140° and the grain should be kept at a temperature of about 10 degrees higher. In the summertime when the humidity is high, it is well to use the glue at 10 degrees higher, or 150° F. Cake glue is prepared in the same way, with the exception that it is soaked overnight.

As to the amount of water to be used, that depends upon the type and grade of abrasive used. For instance, if a No. 60 abrasive is used, the proportion will be 1½ lbs. water to a lb. of glue, provided a standard grade of abrasive glue is employed.

If a fine one such as No. 120 is used, the proportion would be 2 lbs. water to a lb. of glue.

As to the hardness of the wheels, it is quite evident that you are not cleaning the wheels properly. They should be thoroughly cleaned and, if possible, a little alkali cleaner added to the water. After they have been cleaned in this way, they should be allowed to dry thoroughly and then treated with neatsfoot oil to restore to the leather, oil that has been removed in washing, thus keeping the leather soft and pliable. However, if the wheels are not thoroughly cleaned, the glue works into the pores of the leather and the neatsfoot oil will not soften as desired, because it cannot enter the pores.

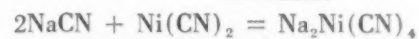
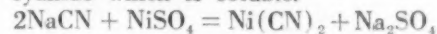
Concerning the trouble you are having with the grease wheels drying out and the surface cracking, it is quite evident that you do not have the right kind of glue for this type of work, or you are using it too strong. If one-half of 1% of glycerin is added, it will greatly improve your product.—T.J.S.

### Analytical Equations

Q. I would appreciate learning the chemical equations in the analysis of metallic nickel and other constituents that comprise a nickel plating solution.

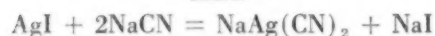
A.—*Metallic Nickel:*

Standard sodium cyanide, when added to the sample, first precipitates nickel cyanide and then combines with the nickel cyanide so formed to produce sodium nickel cyanide which is soluble.

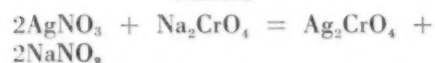
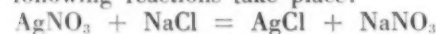


In order to detect the endpoint, a small amount of silver nitrate is dissolved in the sodium cyanide and some potassium iodide is added to the sample to be analyzed. The first

few drops of standard sodium cyanide results in a precipitate of silver iodide in the solution. When all the nickel cyanide precipitate has been dissolved, additional sodium cyanide dissolves the silver iodide precipitate according to the following equations:



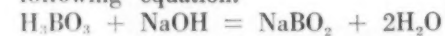
**Chloride:** In a very slightly acid solution containing both chloride and chromate, the addition of standard silver nitrate results in the precipitation of the more insoluble silver chloride. When all the chloride has been precipitated, the excess silver nitrate forms a precipitate of silver chromate which is a deep red. The following reactions take place:



**Boric Acid:** In the procedure given for boric acid in the 1939 edition of *Plating & Finishing Guidebook*, sodium cyanide is added to form the double nickel cyanide for the purpose of removing the color from the solution. The equation is as follows:

$$4\text{NaCN} + \text{NiSO}_4 = \text{Ni}(\text{CN})_4 + \text{Na}_2\text{SO}_4$$

After making the solution just neutral to methyl orange indicator, standard sodium hydroxide is added to combine with the boric acid which acts as a monoacid, according to the following equation.



The endpoint is taken when the color turns from dark green to purple due to the presence of brom-cresol purple indicator. The glycerine which is added does not enter into the reaction, but is present to prevent hydrolysis of the sodium borate.

—N.H.

### Analysis of Boric Acid

**Q.** The following problem relates to the method of determining boric acid in nickel plating solutions as outlined on page 74 of the 1939 edition of *"Plating & Finishing Guidebook."* Starting with the first step on page 74, (C-1) right up to and including C-4, I met with trouble. I prepare my 0.1N sodium hydroxide solution by weighing out 4 grams in a little water and then I bring this up to 1 liter. When I begin to

titrate C-5 into contents of C-4, I just don't seem to get the red color to change to dark green; or in other words, the beaker stays a red color.

**A.** In the method given for determination of boric acid on page 74 of the 1939 *Plating & Finishing Guidebook*, paragraph 3 should read: Add ½ cc. of *methyl orange* indicator and then add 10% hydrochloric acid solution until the color just changes from yellow to *orange*.

The underlined words are the ones changed from the text. —G.B.H.

### Storage of Clean Parts

**Q.** Would it be possible to clean cold rolled steel and hang it in some kind of bath or solution, so that it would be ready to hang in the nickel solution as soon as the preceding run comes out of the tank. Also, could copper plated steel be handled this way.

**A.** Storing of parts after cleaning and before plating should not be done any more than necessary. Films will be formed that will effect adherence of the deposit.

For short periods of time steel and copper plated steel can be placed in a 4 oz./gal. solution of soda ash. A solution of 1 oz./gal. of cream of tartar can be used for copper plated parts. For straight steel, a solution of 2 to 4 ozs./gal. of sodium cyanide can be used.

If possible, after removing work from these storage solutions, give it a light flash in cyanide copper solution. In any case, just before going into the nickel solution, it is advisable to dip the work in a crock of nickel solution which has been made acid with sulfuric acid to a pH of 5.2 approximately. Go direct from this dip into the nickel plating solution. —G.B.H.

### Bright Burnishing

**Q.** We would like to secure a brilliant finish on the samples of parts submitted. Will you kindly give us your recommendations.

**A.** If the ball burnishing operation is expertly handled, the finish secured is usually bright enough to meet any required standards. Care must be taken to assure an absolutely clean barrel interior, clean burnishing materials and the parts themselves must be free from oil,

grease or impurities before they are placed in the burnishing barrel.

A run in scrap leather is occasionally used to improve the finish on some products. Here again cleanliness is essential. The wood tilting barrel must be clean and the leather scrap must be clean.

No mention was made of the method by which the parts are dried after burnishing. If a centrifugal dryer is not used, the parts are probably dried in a wooden tilting barrel with sawdust. Here again cleanliness enters into the picture as both the barrel and the sawdust must be clean. Hard maple sawdust is preferred by most companies.

After the drying operation, the parts can be placed in the wooden tilting barrel with unfinished russet sheepskin leather pieces free from stains, dirt, etc.—J.H.D.

### Immersion Silvering

**Q.** Please send us formula of a solution to deposit silver over engraving on silver plated ware, together with instructions on how to use this solution.

**A.** The duPont company has given the following formula for an immersion silver in one of their publications:

Sodium cyanide	0.2 oz.
Silver cyanide	0.5 "
Sodium chloride	0.5 "
Water	1 gal.

The cyanides are poisonous.

A non-poisonous formula is: (Blum & Hogaboom, page 347)

Silver nitrate	2 parts
Ammonium chloride	1 "
Sodium thiosulphate	4 "
Calcium carbonate	4 "

Mix with water to form a paste. Rub on the parts to be silvered.

The silver films produced by these methods will be very thin and will not last long. If slightly heavier deposits are desired, "sponge" (or "brush") plating can be performed. In this method, the article to be plated is made the negative terminal of a source of direct current (such as a dry cell), and a brush or sponge containing an anode is connected to the positive terminal. The brush is dipped in silver plating solution and then brushed back and forth on the area to be plated. The names of suppliers of brush plating equipment can be secured from *Metal Industry*.—G.B.H., Jr.



# ELECTROPLATING DIGEST

SELECTED ABSTRACTS ON PLATING—FINISHING—RUST PROOFING—LACQUERING

## Reflectivity Measurements of Silver Alloys\*

(Reflexionsmessungen an Silberlegierungen)

Von Ernst Raub und Max Engel

The authors have made a study of the light reflectivity in the visible wave lengths of binary and ternary alloys of silver containing beryllium, aluminum and silicon, and the possibility of producing tarnish resistant oxide coatings was investigated. These investigations led to the following results:

Alloyed beryllium and silicon sharply reduce the reflectivity of polished silver surfaces. The production of a uniformly smooth surface by polishing is hindered by the presence of harder beryllium and silicon containing crystals. Aluminum also distinctly reduces the reflectivity of silver, but so long as the amount of aluminum contained therein does not exceed the solubility limits of the silver-rich solid solution phase, the decrease remains rather small.

Beryllium and silicon retard, in a limited manner, the tarnishing of polished silver. With polished and rolled alloys, no outstanding difference is to be noticed in the resistance against tarnishing.

Alloyed aluminum always strongly decreases the tarnish resistance of silver. The small increase in tarnish resistance of polished silver alloyed with beryllium is lost if the alloy contains beryllium oxide.

The thermal treatment for the production of tarnish resistant coatings of pure aluminum, beryllium or silicon oxides on alloys of silver containing these metals, proposed by Price and Thomas, is not suitable for the practical production of tarnish resistant silver.

The recrystallization by heating of rolled silver, reduces the reflectivity about 10%. Complete recrystallization at higher temperatures further reduces the reflectivity very markedly. It was not found possible to produce coherent coatings of aluminum oxide or metal from solutions of aluminum salts by electrolysis with silver as the cathode. On the other hand, satisfactory coatings can be obtained from beryllium salts. Properties of the oxide coatings obtained from beryllium solutions are strongly dependent upon the degree of the acidity of the electrolyte.

Beryllium oxide coatings obtained from beryllium sulphate and nitrate solutions had good adhesion to the base metal and with sufficient thickness had considerable resistance to mechanical abrasion. In the

pH range from 5.8 to 6, beryllium hydroxide deposits from the solution in a flocculent state, and after electrolysis upon silver, grayish-white, partly non-coherent coatings are obtained. With increasing acidity of the solution, the deposits at the cathode become weaker and show interference colors. Finally, when a pH range from 4.2 to 4.4 is reached, the interference colors disappear and no visible coating is produced.

The reflectivity of the silver drops noticeably after being coated with the beryllium oxide or hydroxide deposits. Silver deposits change their reflectivity very little with time when coated with beryllium oxide from beryllium sulphate solutions. With pH's between 5 and 6, the reflectivity, however, in the fresh state of the coated silver lies more or less, depending upon the method of treatment, below that of pure silver.

From the extensive observations made by the authors, it was concluded that beryllium oxide deposits offer no prospect for the production of tarnish resistant silver.

## Pickling of "K" Monel

Reprinted from *Engineering Properties of "K" Monel*, Bulletin T-9, Development and Research Division, The International Nickel Co., Inc., 67 Wall St., New York, N. Y.

"K" Monel is a corrosion resistant wrought alloy of nickel, copper and aluminum, which possesses excellent corrosion resistance characteristic of Monel together with the added advantages of greater strength and hardness. The composition of "K" Monel is nominally as follows:

	Per Cent
Nickel .....	66.0
Copper .....	29.0
Aluminum .....	2.75
Iron .....	0.9
Manganese .....	0.4
Carbon .....	0.15
Silicon .....	0.25
Sulphur .....	0.005

Pickling practices recommended for Monel are satisfactory for "K" Monel also. Material that has been heated in a reducing atmosphere, or that has been alcohol-water quenched is pickled readily using formula (1).

- (1) Water ..... 1 gallon  
Sulfuric acid (66° Be.) ¾ pt.  
Sodium nitrate (crude) ½ lb.  
Sodium chloride (com.) ..... 1 lb.  
Temperature ..... 180°-190° F.  
Time ..... 30-90 minutes

If the material carries a thin or moderately thick oxide scale, formula (2) should be used.

- (2) Hydrochloric acid (30° Be.) ..... 1 gallon  
Water ..... 2 gallons  
Cupric chloride ..... ½ lb.  
Temperature ..... 180° F.  
Time ..... 20-40 min.

If cupric chloride is not available, it may be omitted. It is beneficial in speeding up the loosening of the scale.

After pickling in formula (2), the work should be rinsed in hot water and then dipped in formula (3).

- (3) Water ..... 10 gallons  
Sulfuric acid (66° Be.) 1 gallon  
Sodium dichromate ..... 11 lbs.  
Temperature ..... 70°-100° F.  
Time ..... 5-10 min.

After pickling, the metal should be washed thoroughly in cold water and any traces of acid should then be neutralized by a dip in:

- (4) Water ..... 6 gallons  
Aqua ammonia (26%-28%) 1 pt.

Since wooden tanks have a comparatively short life, organic coated steel tanks, ceramic vessels, or acid resisting brick-lined tanks are recommended.

More detailed information is available in Bulletin TS-4, "Pickling Monel, Nickel and Inconel".

## Cleaning Tinned Equipment

Reprinted from *Tin and Its Uses*, October 1939, No. 3, p. 11, International Tin Research and Development Council.

The life of tin coated equipment, which is so widely used in the dairy and other food industries, is usually more affected by cleaning operations than by normal service.

The cleaning of such equipment is carried out by the use of hot solutions of one or more mild alkalis, such as sodium carbonate, tri-sodium phosphate, sodium metasilicate or sodium di-silicate. Investigation has shown that in themselves hot solutions of these chemicals have little effect on tin, but that in the presence of oxygen their attack is quite rapid. As it is impracticable to exclude air in cleaning operations the ingenious expedient has been devised of adding a chemical which will combine with the oxygen before it has a chance to attack the tin.

Sodium sulphite has been found suitable for this purpose, and it possesses the

(Concluded on page 52)

\*Abstracted from *Zeitschrift fuer Metallkunde*, 31, No. 11, pp. 339-344 (1939).

# Post Scripts

All of the comments received since telling about our Detroit friends' complaint regarding Post Scripts, have been favorable, and one communicant from Detroit has reported that even several Detroiters were observed peeking at Post Scripts before they examined the rest of the magazine. *George Simmons* summarized the viewpoint of most of the readers in the following letter:

"Dear Dr. Meyer:

I want to add my voice to the few who perhaps will write you in defense of the very human Post Script section inaugurated by you in METAL INDUSTRY.

It seems to me our Detroit friends are missing something if they have no time to read of the doings, mostly humorous, of their fellow members of the Metal Finishing Craft. I trust it will be continued with no compromises because, after all, if anyone does not care for it, they do not have to read it.

Yours very truly,

Geo. Simmons, Secy.,  
Binghamton-Syracuse Branch, A.E.S."

*Bill Grip*, past president of Los Angeles Branch, American Electroplaters' Society, missed the last several meetings, and his presence on the night on Nov. 8th was a pleasant surprise to the membership. Grip, who has a quite noticeable "high forehead", was importuned to deliver a talk on "How to Grow Hair", but declined gracefully with the statement that he would do so at some future meeting when he had discovered an effective "solution". An anonymous wag suggested that the denuded area be given a pre-coat of diatomaceous earth, followed by a rub-down with a compound of activated carbon and Nuchar C-115. Grip said he would take all suggestions "under advisement".

We are also printing below, a public letter to *Bob Leather*, which was inspired by seeing his ad in M. I., showing deer hoofs.

"Dear Mr. Leather:

Appropos of your ad showing the versatility of your products, (polishing deer's hoofs), I would like to offer the following:

On the authority of the radio program, "True or False", I hear that men's whiskers are made of the same material as animal's hoofs. This would seem to open up an enormous new field for your products.

To stimulate this idea, I am offering, gratis, the following A.E.S. members, who I am sure, would be glad to act as guinea pigs in any experiments you would care to make along these lines.

These men are all of different hair types:

1. The Here and There Whiskers of *Bert Sage*—Buffalo Branch
2. The Fuzz Face of *Austin Fletcher*—Binghamton-Syracuse Branch
3. The Optimistic Updo Hair-do of *Burton Daw*—St. Louis Branch
4. The Don Ameche Mustache of *Geo. (Dead Eye) Merz*—Cleveland Branch
5. The Wish-I-Had-Some-Hair of *Bill Mahar*—Binghamton-Syracuse Branch
6. The Rudy Vallee Coiffure of *Ray Berg-hold*—Rochester Branch

And as a special distinct type, the Benevolent Santa Claus Locks of our Supreme Secretary, *Bill Kennedy*.

I feel there are great possibilities in this.

You're welcome,

Geo. Simmons"

*Joseph Downes* had to meet an embarrassing predicament on the airplane taking him to the Detroit annual meeting. Joe ordered a fish dinner on Friday, but in the absence of fish had to partake of a sumptuous steak dinner. Joe seemed to be particularly upset about it as the picture below illustrates. However, Joe,



*Joe Downes doesn't seem to be worrying about that steak dinner here.*

to appease your conscience we would like to tell you that Friday, December 8th, is not a fast day inasmuch as it is the Feast of the Immaculate Conception.

A sobered Hot Nose Reporter sent in the following log of the Detroit banquet:

For the benefit of those who passed out at 6:49 p.m., this is what happened:

- 7:00 p.m.—Dinner
- 7:01 " —*Carl Heussner* was eating
- 7:10 " —*Higgins* was lost
- 7:11 " —"Where's *Bill Phillips*?"
- 7:14 " —*Fred May* peevish about remarks concerning his golf game
- 7:15 " —Most everyone eating, at least those that could
- 7:18 " —"Has anyone seen *Cleve Nixon* and *Eddie Fritz*?"

7:19 " —*Phil Brockway* looks for prize for best dressed man

7:20 " —Dinner now under way

7:20 to 8:00 p.m.—Waitresses on the run

8:10 p.m.—My Gosh! there's *Floyd Oplinger*, again

8:30 " —Floor show which features the *Amundsen's* twin daughters who did some mighty fancy stepping

Cute kids, too.

9:45 " —"They're all up in 1434"

Among the Christmas week visitors to our office was *E. M. "Stevie" Stephenson* the perennial lacquer salesman in his usual good cheer, and *Philip LoPresti*, chemist for Hickok Company, Rochester, N. Y., who has prepared an interesting article for the February issue. Mrs. Meyer saw his picture in a past issue of M. I. and recognized Phil as a classmate and produced a fifth grade class picture as proof. The youngster shown below is Phil when he had few plating troubles on his mind.



*Charlie Koelbl, New Haven impresario choosing sides.*



*Phil LoPresti back in those carefree days.*

I would like to acknowledge receipt of Christmas greetings from the people listed below. Unfortunately, a large batch of cards was mislaid and if your name is not on the greeting list, your card was probably among the lost group, for which we are sorry.

<i>Al Braun</i>	<i>Wilfred S. McKeon</i>
<i>Barney Case</i>	<i>A. P. Munning</i>
<i>William Chase</i>	<i>John C. Oberender</i>
<i>Carleton Cleveland</i>	<i>Ben Popper</i>
<i>H. Tom Collord</i>	<i>Chas. H. Proctor</i>
<i>R. J. Frank</i>	<i>Bert Sage</i>
<i>Fred Fulforth</i>	<i>Carl Schaefer</i>
<i>Frederick Gumm</i>	<i>George Simmons</i>
<i>Louis M. Hague</i>	<i>T. F. Slatery</i>
<i>G. B. Hogaboom</i>	<i>W. G. "Bill" Stoddard, Jr.</i>
<i>John E. Hubel</i>	<i>Joe Sullivan</i>
<i>Wallace G. Imhoff</i>	<i>O. S. Tyson</i>
<i>George E. Knecht</i>	<i>Fred W. Vogel</i>
<i>Bob Leather</i>	<i>Frank Watt</i>
<i>Keith Lydiard</i>	

*Walter R Meyer*



# NEW EQUIPMENT AND SUPPLIES

NEW PROCESSES, MATERIALS AND EQUIPMENT FOR THE METAL INDUSTRY

## New 24 kt. Gold in Liquid Form

Mark Weisberg Laboratories, Providence, R. I., announce the development of a new certified 24kt. gold in liquid form for electroplating solutions.

This development is said to fill a long-felt need in the jewelry and novelty industry for a standardized gold electroplate. Among its many advantages are uniformity of color, high efficiency and exceptional throwing power, according to the manufacturers.

Available with this new gold are special reagents for preparing electroplating solutions and alloys for pink, red, and green solutions.

## Process for Cleaning Die Castings

MacDermid, Inc., Waterbury, Conn., have announced the development of a new process for removing buffing compositions from zinc base die castings, called the "Dyclene" process.

It is stated that this process produces a metallurgically and chemically clean surface quickly and economically.

Dyclene "E" is an electrolytic compound used only with reverse current, and it is stated will produce a satisfactory finish in from 15 to 30 seconds without etching the die castings.

Where degreasing machines or pressure alkali washing machines are employed, the Dyclene electric bath is used in conjunction with the preliminary operation.

Where it is advisable or deemed necessary for economical treatment to eliminate such preliminary operations, the Dyclene "S" (soaking operation) is suggested. The concentrations employed in each case are claimed to be extremely low and the material does not decompose rapidly.

Technical bulletins and detailed information are available on request.

## Wax for Aluminum

A new approved wax, designed to protect the production finish during handling, shipping and erection, has been announced by The Skybryte Company of Cleveland. Known as Production Wax No. 2, this liquid material is applied with brush or cloth and is allowed to remain on until after erection, at which time it may be rubbed down. It leaves a firm, transparent waxed surface which serves as protection against discoloration. It is said by the manufacturer that it has been approved for use on all aluminum surfaces that have been given an anodic type of treatment and is also suitable for use on bronze, chrome and other bright surfaces.

## New High Strength Filter Paper for Filter Presses

The Enthone Co., 442 Elm St., New Haven, Conn. has announced the sale of a new high strength paper for filter presses which is claimed to possess the highest wet strength of any paper on the market for this purpose. The paper possesses exceptionally long fibers and in addition has been given a patented wet strength treatment.

The paper, costing less than a cent a sheet, is placed against the filtering canvas or screen and the filter cake deposits upon the paper, thus enabling rapid cleaning of the canvas by merely removing the filter paper carrying away the filter cake.

It is stated that the high strength of the paper both wet and dry obviates any danger in tearing, both in placing the paper and removing it from the canvas. The paper being only a few mils thick allows tight locking of the plates and frames to prevent leakage.

The paper is fast filtering and tests by the supplier have shown it to possess high strength in acid solutions with pH values as low as 2.0 and in strong caustic solutions up to 15 oz. per gallon of caustic soda.

Some of the advantages claimed for the use of this paper are:



Photomicrographs showing fiber length. Upper, ordinary paper; lower, long fiber paper.

Fast cleaning of filter presses.

More thorough filtration.

Longer life of canvas.

Tight sealing of plates and frames.

Samples and literature can be secured by writing the manufacturer for Bulletin No. 6 stating the make and plate size of the filter press.

## New Paste Solder

Wayne Chemical Products Co., 9600 Copeland St., Detroit, Mich., have announced the development of a new soldering process, which is stated to be faster, simpler and less wasteful of materials than the usual methods of soldering.

The material called "Meltomatic" paste solder is a self-cleaning and self-fluxing paste solder, which simplifies the soldering operation, inasmuch as only an application of paste solder followed by heating is required to produce a soldered joint.



Applying paste solder with a brush.

The solder melts slightly over 400° F. and there is no loss because the amount actually required is placed on the spot to be soldered. One particular advantage that is claimed is that it can be used for soldering spots normally inaccessible to soldering irons, and the solder also permits simultaneous soldering of several articles or units.

The soldering operation consists in applying the paste with the brush, heating, and wiping with a cloth.

A 4-page folder describing this and other products of the Wayne Chemical Products Company is available.

## Professional Directory

### G. B. HOGABOOM, JR. & CO. Consulting Chemical Engineers

Solution analysis, plant design, process development. Testing of deposits—composition, thickness, porosity, salt spray.

352 Mulberry St. Newark, N. J.

### J. B. KUSHNER, B.S., Ch. E. "Personalized Plating Service"

Plating bath analyses made on your premises. Installations. Advisory service.

192 Broadway, N. Y.

CORtland 7-1156

# Electroplating Rack Coating

—A Material of Many Uses

By Myron B. Diggin

Chief Chemist, Hanson-Van Winkle-Munning Co., Matawan, N. J.

One of the important accessories of the electroplating shop is the insulator or "resist" used in coating racks on which the work is hung. The primary purpose of this resist is to confine the metal deposit to the work itself by preventing the deposition of metal on any other part of the rack. The need for such a rack coating and its advantages are so manifest that they call for no explanation other than the simple statement that they save the important items of metal and power which would otherwise be consumed in coating the racks as well as the work.

In recent years, rack coatings have been vastly improved by the use of materials which were formerly strangers to the industry—synthetic resins. Coatings made with synthetic resins as a base are not only strong electrical insulators, but are also highly resistant to chemicals—acids and alkalis—over a wide range. Consequently, the greatly increased use of rack coatings has led to the interesting discovery that their properties make them suitable for a variety of hitherto unsuspected applications.



Wrap-Rax insulating tape.

One of the stumbling blocks in the path of making general use of rack coatings has been the problem of applying them. Until recently these coatings were applied exclusively by dipping the racks or parts to be coated into a tank of the liquid resist. This procedure restricted its use to portable or mobile parts. In coating racks by dipping there has always been the problem of eliminating the last traces of solvent, which, if not removed, produces pin holes or porous spots. However, the recent development of a synthetic thermoplastic resin in tape form has eliminated this difficulty. This material can be applied in the same manner as friction tape, being wound spirally over the parts to be protected with a  $\frac{1}{8}$ " or  $\frac{1}{4}$ " lap. Wherever joints are encountered, the tape is split to narrow widths and crisscrossed to obtain perfect coverage. The conventional method of sealing the tape into one homogeneous coating is to

bake it in an air oven for about 20 minutes at 230° to 250° F., but on parts that cannot be moved, the sealing can be accomplished by flashing the tape winding with the standard gasoline blow torch, in very little time, with ordinary care.

Specific examples of such special applications show the broad usefulness of such tape. In one plant, a water line feeding a spray rinse was so placed that acid from a pickling tank dripped on this pipe every time something was removed from the pickle. It was necessary to replace this pipe every three or four weeks and although many kinds of acid proof paints had been tried, it was found that these did not stand up very much longer. It was suggested that the pipe should be wrapped with this synthetic tape and fused with a gasoline blow torch. This suggestion was followed, and now, after a long period of operation, the pipe is still intact.

Another case involved small alloy steel burnishers which are used largely in automatic telephone systems, for remote control and for many industrial applications. These parts require, during maintenance, the cleaning of their contacts when they become dirty or roughened. An insulating handle is required for the burnishers, which presented quite a problem. It was finally solved by using a small piece of the synthetic tape folded around one end of the burnisher and slipped into a heated molding die and pressure applied for a time. It was then opened under cold water. After washing the burnisher chemically clean, it was ready for use.

In a sulphuric acid plant, it was found that very good protection could be obtained by using such tape over the pipes. In any plant in which flexible cables are used, this tape can be applied to advantage. In one instance, as originally installed, the flexible cables were covered with a braided cotton material which soon became so weak that the covering disintegrated and fell into a plating tank. When the bare copper was exposed, it was corroded very badly by the fumes rising from the tank, and these corrosion particles would drop from time to time, into the solution, always leading to trouble. New cables were then installed and wrapped right over the cotton covering with the tape. These have been in service for some time and are still in perfect condition.

In another plating plant they were using inside anodes for plating deeply recessed articles. A slight change was made in the design of the article, and when plated with these inside anodes some burning occurred. In order not to interrupt production, it was necessary to block off certain areas immediately, as making new inside anodes would require over a day. The plating foreman covered the areas which were causing the burning with this tape, and went into production within five minutes. The new inside anodes were

never needed.

This by no means exhausts the possibilities for the uses of synthetic tape around a plating room or chemical plant. It has exceptional chemical resistance to both acids and alkalis. It has a high electrical insulating value and is stable at ordinary and somewhat elevated temperatures. Being a thermoplastic resin, it will soften at around 235° to 240° F., but the user can take advantage of this characteristic to effect a seal between the adjacent layers thus forming a solid piece of resin over the articles.

Parts coated with this tape that have been in service for some time and have been injured mechanically by rough handling can be repaired very easily. Where the coating has been cut or broken through, a patch of tape is applied, after which it is either sealed in an oven or fanned with a torch to seal the edges. A small bottle of cement is furnished with each roll which can be used for cementing the patches.

## Magne-Gage Coating Thickness Tester

The Aminco-Brenner Magne-Gage, an instrument for measuring local thickness of coatings on metals by the rapid, non-destructive magnetic method, has been improved since its introduction in 1937. The improvement, which greatly increases the utility of the instrument, now makes it possible to measure various types and thicknesses of coatings with only one instrument simply by interchanging different types of magnets.



Magne-Gage for measuring thickness of plating.

The instrument as now marketed will measure: (1) nickel coatings on non-magnetic base metals; (2) non-magnetic, metallic or organic coatings on magnetic base metals; (3) nickel coatings on iron or steel.

The method is simple, rapid, non-destructive of the coating or the base metal, and is especially advantageous for both work control and acceptance testing, since it permits testing of a large number of specimens at low cost.

The improved instrument is fully described in new bulletin MI2070, which may be had on application to the manufacturer, the American Instrument Co., 8010 Georgia Avenue, Silver Spring, Maryland.



*"This isn't a Ticket...  
...it's a **TIP!**"*



*...use  
**NICKEL** brass and  
bronze"*



LISTEN to the whirr of a motorcycle engine and take a tip — instead of a traffic ticket. Think of the vibration, road shocks and temperature extremes small bronze motorcycle carburetor castings must withstand — and stay pressure-tight.

That's why Langenskamp, Wheeler Brass Works, Indianapolis, adds 1% Nickel to the usual 85-5-5-5 bronze base mixture when casting motorcycle carburetor parts. Thanks to Nickel, these intricate castings have uniformly dense structure free from porosity and they machine well. And the money-saving tip to casting users is that Langenskamp, Wheeler reports "scrap losses are very low since adding Nickel."

Your consultation on problems involving uses of non-ferrous and ferrous alloys containing Nickel is invited.

**THE INTERNATIONAL NICKEL COMPANY, INC., 67 WALL ST., NEW YORK, N. Y.**

## STAINLESS STEEL POLISHING COMPOUNDS

Are Proven Every Day in Every  
Kind of a Metal Working Plant



**"4-A" Polishing Compounds Are Faster, More Efficient, More Economical for Polishing, Mirror Finishing of All Kinds of Steel, Including Stainless Steel and Other Alloys.**

## CEMENT AND THINNER

Use it on any kind of a wheel, soft, hard, medium. Results will speak more eloquently than anything we could say.

Tell us about your toughest job, and we'll be glad to send the "4-A" product that will solve your problem. No obligation, of course.

*Instead of glue, use "4-A" Cement and Thinner, a uniform substitute for polishing Wheels, Belts, Buffs, Rolls, etc. Samples of Compound or Cement sent on request.*

**HARRISON & COMPANY**  
HAVERHILL, MASS.

## Paint for Use Under Extreme Corrosive Conditions

The B. F. Goodrich Company, Akron, Ohio, has announced a new Koroseal paint, designated as No. 495 Korolac, the name covering solutions of plasticized polyvinyl chloride. A Korolac primer for use with the new paint is also introduced.

The new paint gives a semi-glossy black finish and is recommended wherever extremely corrosive conditions disqualify any other kind of paint or coating. Applied to metal surfaces after they are prepared as for any other kind of paint or lacquer, the primer forms a strong bond between the Korolac and the metal itself.

Korolac No. 495, when thoroughly dry, is claimed to withstand all acids, alkalies and salts in the concentrations commonly met with in industry, up to temperatures of 150° F.

It is not affected by chrome, nickel,

cadmium, zinc, copper, brass, silver or tin plating solutions, nor are such solutions contaminated or fouled by the paint when it is thoroughly dried.

Ordinary atmospheric conditions have no effect on the paint. It is extremely moisture resistant. The dried film is hard and resistant to abrasion, yet sufficiently elastic to conform to contraction and expansion of the support.

Both the primer and the paint can be applied by brushing or spraying.

## Insulating Joints for Electro-Chemical Pipe Lines

Plants employing electrochemical processes such as electroplating, electrotyping or electrorefining have a constant problem; namely, the possibility of electrical grounds through the pipe lines transmitting solutions. To eliminate this danger, the

best practice is to use insulating joints in the lines.

A complete assortment of such insulating joints is obtainable from the Hanson-Van Winkle-Munning Co., Matawan, N. J., manufacturers of electroplating equipment and supplies. These joints, simple in construction, are made of malleable iron and include compressed fibre insulating rings which encircle the ball member at two different places. They are tested for 125 volts direct current service and for 200 pounds per sq. in. steam pressure. They may be safely used under hydraulic pressures as high as 1000 pounds, depending upon the size of the joint. Their flexibility is another advantage, as it prevents pipe breakage due to expansion, contraction or vibration strains.

Insulating joints are recommended for cleaning tanks, plating tanks and heating and cooling lines.

## New Electric Cleaner

Magnuson Products Corp., Hoyt and Third Sts., Brooklyn, N. Y., have announced the development of a new electric cleaning compound for difficult cleaning jobs, heretofore deemed impossible without additional washing with gasoline or other solvents.

This new compound is stated to be most effective for removing polishing compounds from steel pieces having many depressions and crevices that tend to retain the polishing material.

After color buffing on nickel plate, the buffing composition can be removed in the same cleaning tank without injury or discoloration to the nickel.

This compound has been in service for nearly a year under practical operating conditions.

## New 500 Ampere AC Welder

The Hampton Electric Tool Co., 700 Walnut St., Edgewood, Pittsburgh, Pa., has recently added to its line of AC electric welders, a new model known as "E2F."

This welder is designed to operate at either 220 or 440 volts; it can be operated by two operators simultaneously from 30 to 280 amperes each, and by simply shifting a copper bar on top of the welder, it can be operated by one operator from 30 to 560 amperes, having a continuous rating of 500 amperes.



500-ampere A.C. welder.



Electrodes from 1/16" to 1/2" diameter inclusive can be used with this machine making it possible to successfully weld from the thinnest automobile fender to the heaviest casting, it is claimed. The welding heats cover the entire range.

The machine is 20" x 26" x 35" and weighs 460 lbs. It has large handles and is mounted on four easy-to-roll ball bearing casters.

The Hampton welders are being distributed through jobbers throughout the country.

### Addition Agent for Pickling Baths

An addition agent for pickling baths called Pickleen has been announced by The Enthone Co., 442 Elm St., New Haven, Conn. This addition agent is stated to effect a marked lowering in the surface tension of sulfuric or hydrochloric acid pickling solutions which results in saving of acid by drag-out.

The addition of Pickleen, according to the manufacturer, also results in a saving of acid by an inhibiting action but the product is not claimed to be an inhibitor.

It is claimed that the acid pickle containing the addition agent functions also as a cleaner thus enabling smoother and more rapid pickling action on iron or steel which has not been thoroughly cleaned of all grease or oil. The cleaning action, therefore, is reported to help insure proper adhesion of plated coatings after acid dipping, by removing any oil films remaining after alkaline cleaning or normally liberated as fatty acids in the pickle if complete rinsing of the cleaner was not done. It is said to be particularly effective for pickling parts in bulk for barrel plating, hot tinning or galvanizing, because complete cleaning is difficult to accomplish in bulk or basket cleaning.

Pickleen is claimed to be stable in hot sulfuric acid solutions up to 15% concentration and in cold hydrochloric acid up to 1:1 concentrations by volume.

Literature and sample can be secured by asking for Bulletin No. 5.

### Low Base Polishing Lathes

The Hammond Machinery Builders of Kalamazoo announce a new addition to their line of Rite-Speed and Vari-Speed Polishing and Buffing Lathes. It is known as the model 3-RR-27" LOW BASE.

This lathe is a two-spindle machine,



Low base polishing lathe.



## "VORTEXEDDY" SPRAY-RINSE-TANKS ARE THE 1940

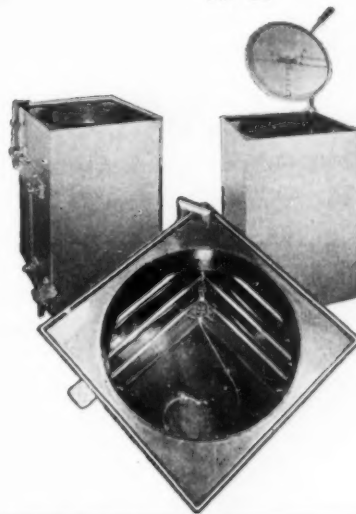
DEMAND OF THE HOUR FOR CUTTING PLATING COSTS AND PRODUCING BETTER RINSING RESULTS

### THE UDYLTE CORPORATION

OF DETROIT, MICHIGAN AND THEIR DISTRICT OFFICES AT

1943 WALNUT ST. 3756 CARNEGIE AVE. 30 EAST 42ND ST.  
CHICAGO, ILL. CLEVELAND, OHIO NEW YORK, N. Y.

and their other distributors throughout the country will gladly and promptly furnish you full particulars and distributor service without imposing obligation.



For your copy of

### "RINSING WITH SPRAY THE STORTS WAY"

address your nearest Udylte  
Office or write direct to—

### STORTS WELDING COMPANY

42 STONE STREET

MERIDEN, CONNECTICUT

Manufacturers of Welded Fabrications to Specification

each spindle being independent of the other having its own magnetic starter, control, switch and brake and motor. The standard lathe measures 63" from one end of the spindle to the other and is fitted with two 3 H.P. motors.

The unusual feature of this lathe is the Low Base Construction as the distance from center of spindle to the floor line is only 27".

Therefore, it is said to be an especially desirable machine on cutlery or any application where it is an advantage for the operators to work in sitting position.

For further information, write the Hammond Machinery Builders, 1601 Douglas Ave., Kalamazoo, Michigan.

### First-Aid Tannic-Acid Treatment for Burns

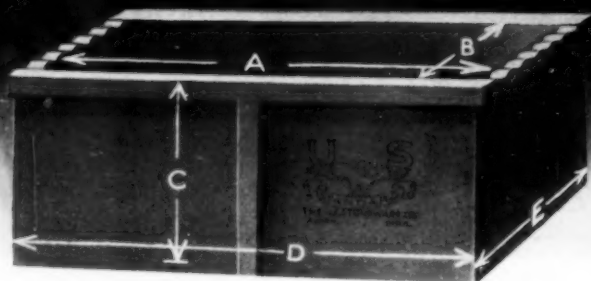
The tannic acid treatment for burns, which is the treatment preferred for this

purpose by most physicians and hospitals, has been made available for use in first-aid work by the Davis Emergency Equipment Company, 55 Van Dam Street, New York.

The Davis preparation, which is known as "Tannoid," consists of a water-soluble jelly containing the proper proportion of tannic acid. When applied to the burn, it relieves the pain, lessens the toxic effect, and reduces the formation of scar tissue, according to the manufacturer. The preparation is merely spread on the burn from a collapsible tube and covered with a compress. Being water-soluble, it is easily and painlessly removable, if further treatment is required.

Tannoid is non-freezing at temperatures as low as 20 degrees below zero, F., thus making it suitable for use on service trucks and in field work. It is supplied in 5 oz. and 1½ oz. tubes, and in unit cartons containing six ½ oz. tubes.

# ACID-PROOF TANKS



Made of "DENSTONE"—an Acid-Proof Chemical Stoneware, dense-bodied and non-porous, and made from De-Aired (Vacuumized) clays.

All tanks are unqualifiedly recommended for electroplating, galvanizing and pickling work. The dense, granite-like body is acid and corrosion-proof all the way through.

Gal.	Length in Inches	Width in Inches	Depth in Inches	List Price
4	12	9	9	\$14.00
10	16	12	12	23.00
16	20	16	12	32.40
26	24	16	16	42.00
38	28	20	16	65.00
41	24	20	20	66.00
44	32	20	16	78.00
66	32	24	20	96.00
69	40	20	20	104.00
104	36	28	24	140.00
119	48	24	24	152.00
149	60	24	24	206.00
210	48	32	32	245.00
320	72	32	32	360.00

Special sizes made to order. List prices subject to discount.

Write for information about our  
CORROSION-RESISTING TANK LININGS for:

- Pickling Tanks for stainless-steel
- Plating Tanks for bright nickel, copper, etc.
- Chromium Plating Tanks
- Pickling, Cleaning and Plating Tanks for all purposes

**THE U. S. STONEWARE CO.**  
WORKS (SINCE 1865) AKRON OHIO

## Cutting-Off Machine

A new machine of the bonded-abrasive wheel type is announced by the American Instrument Co., 8010 Georgia Avenue, Silver Spring, Maryland, for cutting glass, quartz, ceramics, metals, commercial and semi-precious stones, etc., in the form of sheets, rods, tubes, and blocks.

Cuts up to 3½ in. can be made on materials with flat surfaces. Rods, tubing and the like up to 6 in. thick can be cut by rotating the material as it is being cut.

True, clean cuts are made speedily and precisely by means of a motor-driven 12-in. diameter rubber-bonded abrasive wheel (0.04 or 0.06 in. thick)—without chipping or breaking the material.

The machine is especially suitable for slicing all kinds of tubing, and makes extremely short cuts that are made only with great difficulty by other means. For exam-



ple, lengths of 1½-in. diameter glass tubing as short as 1/32 in. can be cut off as easily and quickly as longer lengths, and with smooth, parallel, unchipped edges.

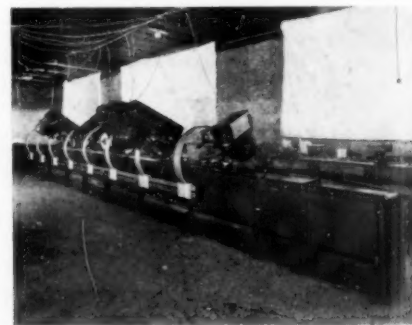
The machine consists essentially of a non-corrosive cutting table (adjustable for cuts of various angles), a cutting wheel direct-connected to a 115-volts 60 cycles a.c. motor, a centrifugal pump (for pumping water from a built-in pump to the spray heads that play steady streams of water from the cutting wheel), mounted on a rigid steel stand.

Complete details are given in the manufacturer's Bulletin No. M.I.2074.

## Straight Line Automatic Polishing and Buffing Machine

The Udylyte Corporation, Detroit, Michigan, manufacturers of electroplating and polishing supplies and equipment, announce the development of a straight full automatic polishing and buffing machine which is said to be designed to reduce polishing and buffing costs to an absolute minimum. It is claimed that this type of machinery will do the work of a number of manually operated lathes; that extremely uniform finishes are secured as each piece receives the identical treatment as the one preceding while the parts are being carried through the machine on the conveyor.

The outstanding mechanical features claimed for the machine are high productivity and flexibility. The machine shown in the illustration, equipped with eight polishing or buffing heads, is capable of polishing 900 bumper guards per hour with three operators. Buffing operations could be handled at a much faster rate.



Straight-line automatic polishing and buffing machine.

The machine is claimed to be very flexible in the sense that it may be used for a number of jobs. Besides bumper guards, it will polish or buff a variety of pieces ranging from flat pieces to irregularly shaped objects. To change jobs, fixtures must be changed and wheels adjusted. Both operations being accomplished quickly according to the manufacturers. As an example of the degree of flexibility of this machine, the manufacturer points out that a straight line full automatic unit as shown in the illustration is now being used for fourteen different jobs in the plant of a large manufacturing concern.



Outstanding construction features claimed by the manufacturer for this type of equipment are as follows:

Constant work pressure control whereby work pressures can be adjusted by a simple operation;

Full floating spindle whereby the polishing or buffing wheel rides gently over the contour of the work being finished;

Variable speed conveyor which will provide speeds between five and forty feet per minute;

Inexpensive fixture carrier and fixtures.

Straight line full automatic polishing and buffing machines can be made any length and with any number of polishing and buffing heads to suit the individual requirements. The Udyllite Corporation maintains a full scale model straight lined machine in its plant in order to provide production executives with an actual demonstration of the equipment.

### New Dipping Basket

The Carpenter Metal Products Co., 446 E. 131st St., Cleveland, Ohio, have developed a line of pickling baskets, such as is shown in the illustration for resisting nitric and sulphuric acids.



*Stainless steel pickling basket.*

The baskets are made of special 18-8 stainless steel and have extra small perforations to replace wire baskets.

### Barrel Grinding Compound

During 1939 Apothecaries Hall Co., Waterbury, Conn., produced a new medium known as L-54 Grinding Compound, to speed up the barrel grinding of small steel or non-ferrous metal parts. This material carries the abrasive in intimate contact with the parts to be ground, resulting in a 50%, or greater reduction in the time of grinding over the usual method, using water and abrasive. The finish produced is smoother and is much

more rapidly brought up to a high luster by the subsequent burnishing operation. A suitable alkaline burnishing compound, supplies lubricant for the final finishing.

This product is being used successfully at the present time by several concerns, who report that the results obtained have been highly significant and most satisfactory.

## Manufacturers' Literature

**Burnishing Compound.** A folder discussing "Leroix," a barrel burnishing soap compound, which is claimed to provide complete lubrication under either acid or alkaline conditions. H. Leroy Beaver, Lansdale, Pa.

## ENTHONE

### Announces Two New Products

#### PICKLEEN—A NEW ADDITION AGENT FOR PICKLING BATHS

A Stable Surface Tension Depressant  
for

Hot Sulfuric and Cold Muriatic Pickling

#### PICKLEEN WILL CUT COSTS BECAUSE:

1. It reduces drag-out losses.
2. It reduces attack on the metal being pickled.
3. It reduces plating rejects by cleaning oil and grease films left from previous cleaning or liberated from the pores of drawn metal.
4. It insures rapid and uniform attack on rust and scale because of increased wetting action.

*Particularly Good For Basket Or Bulk Pickling*

**Economical—Long Lasting**

★ ★ ★

#### HIGH WET STRENGTH FILTER PRESS PAPER

A Long Fiber Paper With A Patented Wet Strength Treatment  
Has Highest Unit Wet Strength Of Any Paper On The Market

#### ENTHONE FILTER PAPER SAVES FILTRATION COSTS:

1. By reducing cleaning labor for filter plates. Just pull off the paper and off comes the cake.
2. Increases life of filter canvas—No scrubbing.
3. Cleaner filtering job.
4. High wet strength prevents tearing.

**Costs Less Than A Cent A Sheet—Cut To Size**

Write today for Bulletin No. 5 on PICKLEEN and Bulletin No. 6 on Enthone Filter Press Paper.

The ENTHONE Co.  Chemical Products  
New Haven, Conn.

**Corrosion Protective.** A folder has been issued by the Corrosion Control Corp., 212 Wright St., Newark, N. J., on "Corres-Co" a new liquid coating that applies and dries like paint. It is recommended for the protection of metal, concrete or wood.

**Heaters.** Bulletin No. 55 features "Nocorodal" (impervious graphitic carbon) tank heaters for protection against chemical corrosion. Heil & Co., 3088 W. 106th St., Cleveland, Ohio. Illustrations are included.

**Humidifying System.** "We Improved Upon the Camel" is the title of a folder issued by Spray Engineering Co., 152 Central St., Somerville, Mass., giving information on "Sprayco" humidifying systems for industrial plants where the winter heating absorbs too much moisture from the atmosphere, causing rejections and affecting production in various ways.

# CLINCO

## CLEAR METAL LACQUERS

Especially formulated for use on cadmium silver and zinc plated articles.

Clinco clear metal lacquers will correct any difficulty which you may have with adhesion, corrosion or tarnishing on the above surfaces.

We would appreciate an opportunity to submit a material that will solve your problems.

We also manufacture a complete line of pigmented lacquers, primers and air dry or bake synthetic enamels for use on metal.

### THE CLINTON COMPANY

1210 Elston Ave. Chicago, Ill.

## ROBERTS WAY IS THE SURE WAY TO BETTER FINISHES

Let us send you samples now for convincing proof that ROBERTS rouges and compounds will improve YOUR product at decreased operating costs.

### THE ROBERTS ROUGE CO.

904 Longbrook Ave.

Stratford, Conn.

Specialists in manufacturing of gold, sterling, and silver plate rouges; stainless steel, chrome, and crocus compounds.

*Maintenance Materials.* A chart, No. 37, has been published by Heil & Co., 3083 W. 106th St., Cleveland, Ohio, on their tank linings, acid-proof paints and coatings.

*Oil Burner.* The new Hauck proportioning low pressure oil burner is described and illustrated in Bulletin No. 405. This "all in one" burner claims the advantages of not requiring extra valves, and of being all ready to hook up to temperature control equipment. Hauck Mfg. Co., 124-10th St., Brooklyn, N. Y.

*Rack Coating.* "Microlite," a rack coating for use in any solution or acid, and "Micro" stop-off lacquers, developed and manufactured by Michigan Chrome Co., 6340 E. Jefferson Ave., Detroit, Mich., are described in this folder, including instructions for use.

*Rubber Insulation.* An 8-page booklet published by Paramount Rubber Service, Inc., 1430 Rosedale Court, Detroit, Mich., which describes and illustrates various tanks to withstand corrosive solutions coated by Paramount with SRL rubber linings. Pickling baskets, dippers and pitchers for acids as well as an anode saver are described.

*Safety Clothing.* The "Steel-Grip" line of safety clothing for industrial hazards, such as gloves, mittens, hand pads, arm protectors, leggings, aprons, sleeves, spats, and welder's clothing, is described and illustrated in a folder. These safeguards are procurable in many different types. Industrial Gloves Co., 701 Garfield Blvd., Danville, Ill.

*Ventilating Unit.* A new ventilating unit designed to remove corrosive, toxic, high temperature and hazardous fumes is fully described in the illustrated 12-page "Bifurcator" catalog issued by the DeBothezat Ventilating Equipment Division of American Machine and Metals, Inc., East Moline, Ill. This unit can be installed as an integral part of the duct system without directional change in air flow.

*Welding Accessories.* The recently issued 20-page booklet of Hobart Bros. Co., Box EW-68, Troy, Ohio, contains descriptions of their electrodes, electrode holders, hood and hand shields, protective clothing, welding, ground and power cables and lugs.

*Welding Electrodes.* This 24-page booklet covers shielded-arc welding electrodes, and contains 1939 joint tentative specifications for iron and steel arc-welding electrodes of the American Welding Society and American Society for Testing Materials. A comparison chart is included. The McKay Co., McKay Bldg., Pittsburgh, Pa.

*Zinc.* This booklet issued by the New Jersey Zinc Co., 160 Front St., New York, contains fine illustrations depicting small tools composed largely of zinc alloy die



cast parts. The name of the commercial die caster making any of the castings shown in this booklet, will be supplied on receipt of an inquiry on a company letterhead.

## New Books

*The Open-Hearth Furnace. Volume III.* By William C. Buell, Jr. Published by Penton Publishing Co., Cleveland, Ohio. Size 9 1/4" x 6 1/4"; 294 pages. Price \$4.00.

This volume of the Open Hearth Furnace considers the design, construction and practice. A comparison of the ancillary systems of selected existing open-hearth furnaces, and the development of basic design principles, are described.

Checkerwork and recuperative and regenerative effects, as well as flues, valves and waste-heat boilers are discussed in detail.

*Standard Chemical & Technical Dictionary.* By H. Bennett. Published by the Chemical Publishing Co., Inc., New York. Size 9 1/4" x 6 1/4"; 638 pages. Price \$10.00.

A condensed technical word book for students, writers, technicians, engineers, scientists, and all others who need assistance in keeping up with the many new chemical, physical, mathematical, engineering and technical words of expression.

It is a compilation completely covering industrial products, chemicals and trade names, abbreviations and contractions, as well as the symbols used in mathematics, chemistry, thermodynamics, pharmacy, etc.

A special section is devoted to the explanation and the proper naming of the organic compounds. The rules for the nomenclature of the organic compounds are stated clearly. The prefix names of the organic radicals supplement this.

Every device has been used to make the dictionary one that is practical and easy to use. Complete cross references are used. Matter of a similar nature is grouped together. A standard system of alphabetizing has been used which makes it possible to find even the most complex organic compound. The symbols have been arranged so that any one can be found at a moment's notice.

There is no field of recent endeavor which is not included among these 25,000 definitions.

## Associations and Societies

### American Electroplaters' Society Chicago Branch

The Chicago branch will hold their annual educational session and banquet on January 27th at the Palmer House, Chicago, Illinois.

The educational session will start at 2:30 p.m. and the banquet will be served in the grand ballroom at 7 p.m. The

## Silicosis in the Polishing Room

- Tripoli, Coloring Compounds and some other buffing compositions are composed essentially of silica in the particle size which causes silicosis.
- Recent medical investigations have shown that aluminum dust when present with silica dust prevents silicosis.
- It has long been known that the presence of aluminum dust in buffing compounds will aid in cleaning when alkaline cleaners are used. A patent owned by us covers the use of aluminum dust in buffing compounds.
- Superintendents, and foremen in charge of polishing rooms, will be interested in this method of reducing their risk without any sacrifice of their composition efficiency.
- Those interested should write for further information. A very interesting booklet giving full details will be sent.

## KOCOUR CO.

4720 S. Christiana Ave.

Chicago, Illinois

tickets for the banquet will be \$3.50 per person.

M. H. Longfield, Secretary.

### Baltimore-Washington Branch

The Branch will hold its annual dinner and educational session Saturday, February 3rd.

The educational session will begin at 2:30 P.M. in the lecture room, Engineering Bldg., University of Maryland, College Park, Md. The dinner is scheduled for 7 p.m. at the Calvert Inn, College Park, Md., tickets priced at \$2.00 a plate. Speakers at the educational session include:

1. R. O. Hull, E. I. Dupont de Nemours and Co., Grasselli Chemical

Dept., Cleveland, Ohio, who will speak on Black Molybdenum Electrodeposits.

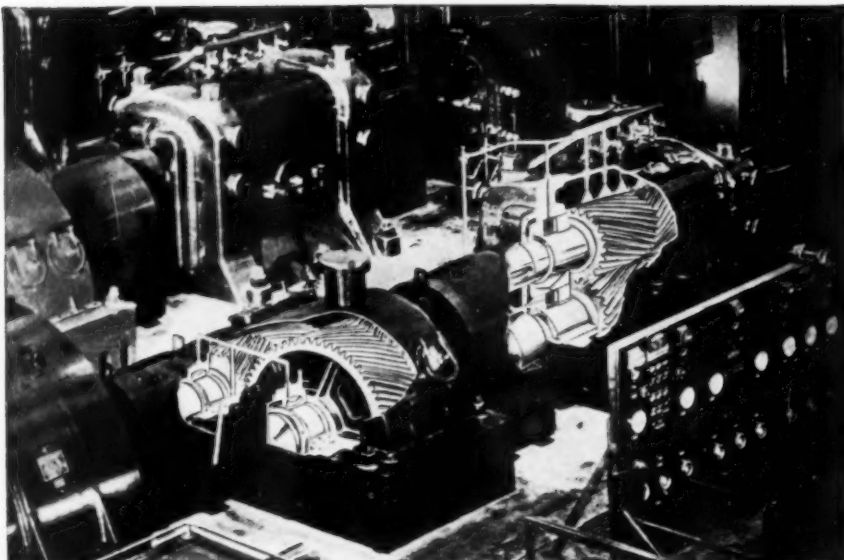
2. W. B. Stoddard, Jr., of New York City, who will speak on his recent experiences as plating advisor to the Soviet government.

3. Austin B. Wilson of the Chevrolet Motor Corporation, Detroit, Mich., who will give an illustrated talk on Bumper Bar and Anode Manufacture.

4. Dr. W. A. Wesley of the International Nickel Co., Inc., who will speak on the nickel chloride plating bath.

### Boston Branch

At the Boston Branch meeting held



## FARREL MILL DRIVES

### Deliver Unfailing Performance Under Severe Operating Conditions

The rugged construction of Farrel Heavy Duty Mill Drives and Pinion Stands enables them to withstand the stresses, shocks and wear accompanying high speeds and heavy loads and to perform dependably under the severe conditions of modern mill practice.

Precision built, they excel in uniform, silent and positive transmission of power—provide the quiet, smooth operation as necessary in large mill drives as in smaller machines.

The dependable performance of

Farrel Drives is the result of modern design, modern materials and modern methods of construction, properly combined and applied by engineers and mechanics who have a thorough knowledge of the problems involved.

Farrel Drives are specially engineered for the individual conditions under which they have to operate. *They are built to fit the job.* On your next drive problem take advantage of the experienced counsel and expert assistance our engineers can give you.



**FARREL-BIRMINGHAM COMPANY, Inc.**  
ANSONIA, CONN.

New York • Buffalo • Pittsburgh • Akron • Chicago • Los Angeles

Thursday evening, December 7th, and presided over by President DeLorme, four applications for membership were presented, the applicants being as follows:

Leslie E. Guilford, Associate, Waltham Watch Co., Waltham, Mass.

Joseph R. Hughes, 198 Rock Island Rd., Quincy, Mass.

Bruce E. Warner, Active, Y.M.C.A., Worcester, Mass.

Raymond A. Gosselin, Active, 32 Tremont St., Cambridge, Mass.

Everett R. Ryan, 29 Pine St., Greenwood, Mass., Associate, was elected to membership.

The Branch extended their sympathy to the family of the late Oliver J. Sizelove, in their bereavement, by standing in silent

prayer.

Colgate Gilbert was appointed chairman of the coming banquet committee.

Librarian E. Jeveli introduced the speaker of the evening, Dr. Saltonstall, of The Udyllite Corp., who spoke on Nickel Plating. His talk and the discussion took until a late hour.

A. W. Garrett is secretary.

#### Detroit Branch

The speaker at the February 2nd meeting will be Willoughby G. Sheane, General Electric Co., Bridgeport, Conn., whose talk will be entitled "Increasing Material and Labor Utilization Through Sprayer Technique." This talk will be illustrated with moving pictures.

Floyd F. Oplinger of the duPont company, spoke at the January 5th meeting, the subject of his talk being "The Cleaning of Die Castings."

#### Newark Branch

The speakers and dates for January and February are as follows:

January 5th, Philip Sievering, Philip Sievering, Inc., New York—"Electroplating and its Progress."

January 19th, L. Eckelmann, Pyrene Mfg. Co., Newark, N. J.—"The Relation of Finish to Product."

February 2nd, S. L. Lopata, The Duriron Co., Inc., Dayton, Ohio—"Practical Aspects of External Heating and Filtration of Plating Solutions." (Illustrated)

February 16th, A. P. Munning, Munning & Munning, Inc., Newark, N. J.—"The Dynamics of Polishing."

#### Los Angeles

Preliminary plans for building up membership in advance of the annual Educational Session and dinner dance of Los Angeles Branch, American Electroplaters' Society, which is scheduled for a still undetermined date in March, were discussed at the organization's monthly meeting at the Rosslyn Hotel, Los Angeles, December 13.

As one phase of a general program for encouraging membership increase it was decided to make the January 10 meeting a "sponsor" affair, with the different members sponsoring a former or prospective member to the extent of paying for his dinner at the January meeting.

The proposal was an elaboration of a suggestion by Ernest Lamoureux that the January meeting, and future meetings, be made more inviting to former members by arranging a more comprehensive program of speakers. D. M. Bedwell thereupon put forth the thought that speakers alone would not have much effect inducing lackadaisical former members to attend. His suggestion for a "guest" night was adopted. Promises of sponsorships for 12 guests were filed with Secretary Ray Sullivan at the December meeting, some members underwriting for more than one guest, and others accepting financial responsibility for guests to be chosen at a later date. Mr. Bedwell's suggestion that former members be advised that they may rejoin without payment of back dues was approved.

President Ray Bray appointed Mr. Bedwell as chairman of the arrangements committee for the March Educational Session, with the privilege of choosing his own assistants. Mr. Bedwell thereupon named the following as committeemen: Ernest Lamoureux, C. E. Thornton, M. D. Rynkofs, Emmet Holman, Ray Sullivan, William A. Vensel, Ray Bray, Bruno H. Schindler, Herold J. Kroesche, Earl Coffin and Fred A. Herr.

The committee will hold its first meeting in January at the call of Chairman Bedwell.

H. G. Martin, chemical engineer for the Johns-Manville Co., and William Broughton, representing Morris P. Kirk and Sons Co., were the speakers at the December meeting.



Mr. Martin delivered a brief address preliminary to presenting a 45-minute motion picture depicting the Johns-Manville Co.'s methods of mining and processing diatomaceous earth, and laboratory scenes showing numerous primary and comparative tests of Celite as a filter. Mr. Martin's talk, as well as that of the commentator in the motion picture, centered on the uses of diatomaceous earth as a filter in various industries—electroplating, sugar refining, gasoline distilling, industrial laundrying, and others.

Mr. Broughton delivered a 15-minute talk on die-casting, using as his keynote, "What's wrong with the plating of zinc die castings?" He stated that the principal fault with zinc die cast plating is "not enough thickness of plating." He listed faulty cleaning, faulty casting surface, too much grinding, too thin a primary copper deposit, and incorrect solutions as other reasons for defective work in plating zinc die castings.

The application of *Anthony Schulo* for associate membership was approved.

#### New Haven Branch

The monthly open meeting of the Branch will be held Tuesday, January 16, at the Sterling Chemistry Laboratory of Yale University.

The speaker for the evening is *Sam Tour*, well-known metallurgist of *Lucius Pitkin, Inc.*, New York, who will give an illustrated lecture on Electro Polishing.

*Joseph Sullivan*, secretary.

#### Masters' Electro-Plating Association

A most successful meeting with 300 members in attendance was held at the Hotel Delmonico, New York City, on Saturday, December 16th.

The guest of honor was *Philip Sievering, Sr.*, who was honored for his 50 years of service to the electroplating industry.

*Adolph Bregman*, Consulting Engineer and Executive Secretary of the Association, was Toastmaster.

*John J. Forbath*, Chairman of the Executive Committee, welcomed the members and guests to the meeting and explained the objects and aims of the Association.

*V. W. Todd*, President, *Hanson-Van Winkle-Munning Co.*, Matawan, N. J., gave an interesting talk about his company's experience with *Philip Sievering* as a customer, and *J. S. Gildersleeve*, President, *Golden Gate Mfg. Co.*, was warm in praise of Mr. Sievering as a supplier. Perhaps the most touching tribute was that from one of Mr. Sievering's employees, namely, *I. J. Liebowitz*, who spoke of his 25 years' association with Mr. Sievering as his employer.

*Dr. William Blum* of the Bureau of Standards, gave an outline of the importance of research and specifications to plating practice.

The highlight of the evening was a presentation by *Walter Plumacher*, Past Chair-

man of the Executive Committee, of a miniature gold plated plating tank to *Philip Sievering*, as a token of the Society's esteem.

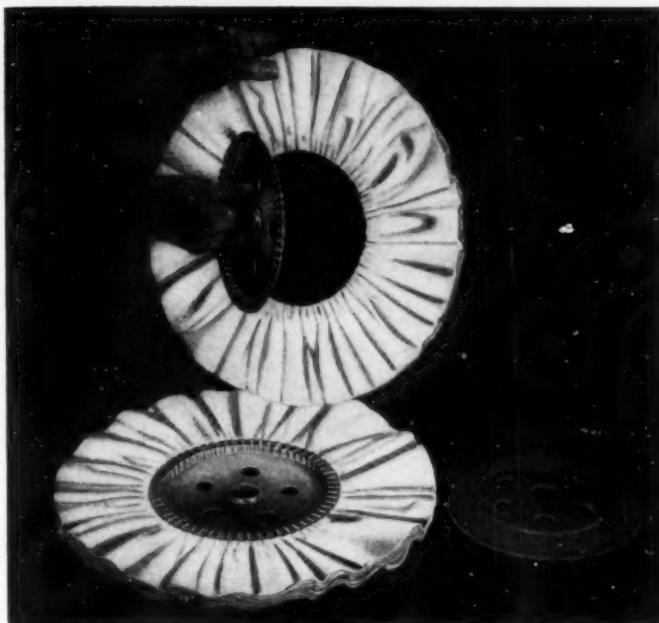
*George Morrow*, *Egyptian Lacquer Mfg. Company*, Master of *Legerdemain*, astounded the meeting by his presentation of magic.

The formal program was followed by dancing to the music of *Otto Bender* and his orchestra, with songs led by *Edward McGowan*.

#### American Society for Metals

##### New York Chapter

Chairman: *J. W. Sands*, International



## Fast Speeds on Polishing Lathes with BIAS Air-Cooled Buffs

This year may call for bigger production in all industry; more work in quicker time. Your polishing and buffing will be stepped up. High speed buffs will be demanded, and Bias Air-Cooled Buffs are here to meet that demand 100 per cent.

Pictured above is our ventilated metal center Bias Buff.

Admitted through the vents in the metal plates, is a constant flow of air which circulates freely between the sections of the wheel and prevents burning—no matter how fast the speed.

These buffs are made on the famous Bias principle used by us for 19 years.

Put this buff to work for you at once.

## BIAS BUFF & WHEEL CO., Inc.

430 Communipaw Ave.  
Jersey City, New Jersey

WARNING NOTICE: The Bias Buff & Wheel Co., Inc. are licensed by the Jackson Buff Corporation of Long Island City, New York, with full rights to manufacture under U. S. Patents No. 19,894 and No. 2,140,206 which have broad claims covering an air-cooled buff having means for the admission of cooling air through the sides of the buff. Manufacturers of buffs are warned against infringement of the claims of these patents as the owners and the licensees intend to protect their rights under these patents and stop infringement. Also U. S. Patent 2,804,923

Nickel Co., New York.

Secretary: *T. N. Holden*, *Holden-Printz Co.*, New York.

Educational Committee: *G. L. Craig*, *Calumet & Hecla Cons. Copper Co.*; *J. B. Austin*, *U. S. Steel Corp.*

The winter educational activities will be devoted to the "Nature and Significance of Corrosion." The New York Chapter has secured a number of speakers who possess broad knowledge on this subject. These educational series are open to all who may be interested. There are no registration fees or other charges made.

After each lecture, encouragement is given to promote discussion on details relating to the subject of the lecture.

## The Rack Coating That **OBSOLETES** TAPE, SPECIAL TREATMENT and BAKING



The application of Microlite requires only three simple operations. The rack is thoroughly cleaned before receiving the first coat . . . is dipped the recommended number of times . . . is hung up to air-dry after each dip. There is nothing more to do to secure a protective coating that is highly effective in any solution or acid. No tape or special treatment is needed, nor is it necessary to bake Microlite after it is applied.

As it can be dipped faster and will air-dry more rapidly than any other material of its kind, Microlite offers the quickest as well as the simplest method of coating your plating racks. In one day, a man can, by hand-dipping, complete the coating of more than 70 racks—all of which will be ready for use the following day. And, in checking the economy of Microlite, you'll find the cost per rack is amazingly low. Be sure to write for the completely descriptive Microlite circular.

# MICROLITE

Developed and Manufactured by Experienced Platers

**MICHIGAN CHROME COMPANY**

6348 East Jefferson Avenue • Detroit, Michigan

The lectures this year will be given in the Merchants Association rooms on the 9th floor of the Woolworth Bldg., Broadway and Park Pl., N. Y. City. They will be given on Tuesday evenings commencing January 9th at 6:30 P.M. sharp.

*Lecture I, Part 1*—January 9, 1940. The Nature and Significance of Corrosion. Lecturer: *Robert J. McKay*, The International Nickel Co., Inc., N. Y. City.

*Lecture I, Part 2*—January 16, 1940. The Nature of Corrosion-Demonstrations. Lecturer: *F. L. LaQue*, The International Nickel Co.

*Lecture II*—January 23, 1940. Principles and Practice of Corrosion Testing. Lecturer: *L. W. Hopkins*, American Chain & Cable Corp., Bridgeport, Conn.

*Lecture III*—January 30, 1940. Influence of Composition and Treatment, with particular reference to Iron and Steel. Lecturer: *C. P. Larrabee*, Corrosion

Laboratory, Carnegie-Illinois Steel Corp., Vandergrift, Pa.

*Lecture IV*—February 6, 1940. The Prevention of Corrosion. Lecturer: *Dr. R. M. Burns*, Bell Telephone Laboratories, New York.

### American Foundrymen's Association

Metropolitan New York-New Jersey  
Chapter

Meetings held at Essex House, Newark,  
N. J.

On Tuesday, January 2nd, *Sam Tour* of Lucius Pitkin, Inc., New York, addressed the Branch on "Production of Non-Ferrous Castings."

Monday, February 5th, a meeting will be held on Equipment, at which time, representatives of prominent equipment makers will speak.

## Personals

*W. B. Stoddard, Jr.*, has become research electrochemist for the Champion Paper and Fibre Co., Hamilton, Ohio.

Mr. Stoddard graduated from Colorado University in 1929 and has spent the past three years in Russia as chief technical consultant on research and production for a large automobile factory.

*S. E. Bramer*, president of Copperweld Steel Company, Glassport, Pa., has announced the appointment of *Frederick J. Griffiths* as executive vice-president in charge of the newly-created Alloy Steel Division of the company. The appointment follows the earlier announcement by Mr. Bramer that the company has purchased the plant and assets formerly owned by the American Puddled Iron Company at Warren, Ohio. On the 423-acre property will be erected a \$2,000,000 steel plant including electric furnaces and other equipment capable of producing 100,000 tons of high quality alloy steel annually, part of which is to be used in the manufacture of copperweld wire, rods, and strand of copper-covered steel.

**Robert R. Sizelove Becomes Technical  
Advisor to Frederick Gumm Chemical  
Company**

*Robert R. Sizelove*, son of the well-known and beloved late *Oliver J. Sizelove*, has been appointed technical advisor and sales representative of the Frederick Gumm Chemical Company, Kearny, New Jersey.



*Robert R. Sizelove*

Mr. Sizelove is a Chemical Engineering graduate of the Newark College of Engineering and has worked with his father in the plating industry for 12 years.

Bob has been assistant technical advisor to Frederick Gumm Chemical Company for some time and he has a wide circle of friends in the electroplating industry.



**Udylite Announces Personnel Change  
in New York Office**

The Udylite Corporation of Detroit, Mich., manufacturers of electroplating and polishing equipment and supplies, announce the appointment of **A. B. Hoefer** as Eastern District Manager with headquarters at 30 East 42nd Street, New York City. Mr. Hoefer replaces **W. L. Cassell**, former Eastern District Manager who resigned recently to join **MacDermid, Inc.**, of Waterbury, Conn.



**A. B. Hoefer**

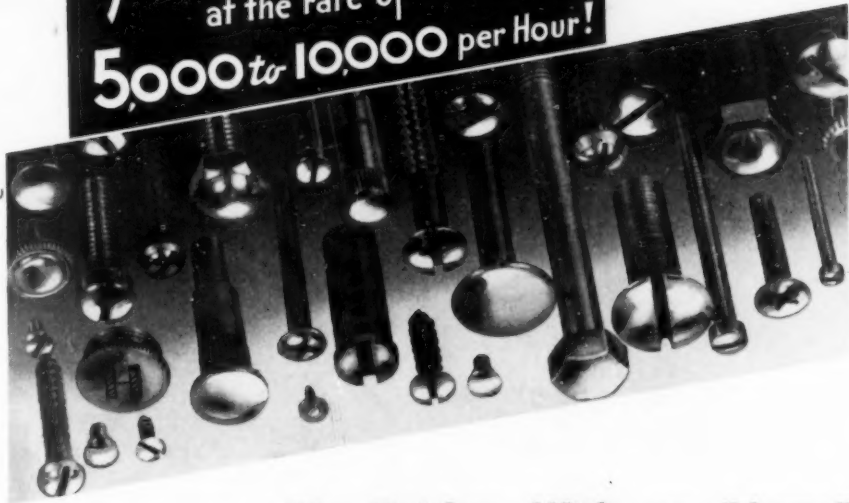
The Udylite Corporation also announces the transfer of **L. J. George**, sales engineer, from Cleveland to the New York office of the company. Mr. George is also a graduate of Purdue University, School of Chemical Engineering. He has been with Udylite since 1929.



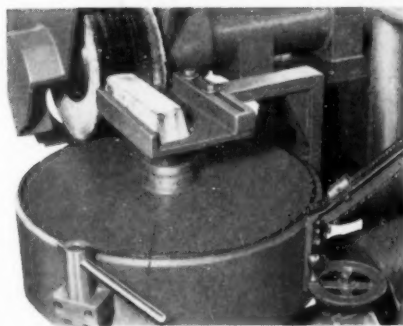
**L. J. George**

Mr. Hoefer graduated from the School of Chemical Engineering, Purdue University in 1928. Immediately following his graduation, he entered the employ of the General Chromium Corporation, Detroit. Early in 1929 he joined the New York office of the Udylite organization as sales engineer.

**Screw Heads  
Polished or Buffed  
at the rate of  
5,000 to 10,000 per Hour!**



**It's Quicker With an "Acme"!**



**Acme Type "SM"**

For polishing or buffing flat or oval-head screws—also hinge pins, rivets, lock barrel facings and other cylindrical parts—an Acme "SM" Automatic is three to six times as efficient as the old method. Besides, it produces a better finish, with a minimum of rejects.

This is, of course, but one of the many types of Acme polishing and buffing machines in widespread use for speeding up production and reducing operating costs. If you have a buffing or polishing problem, the chances are there is an Acme machine that will solve it.

**Send Sample for  
FREE Production Estimate**

**ACME Manufacturing Co.**  
1642 HOWARD ST. • DETROIT, MICH.  
*Builders* OF AUTOMATIC POLISHING AND BUFFING MACHINES FOR OVER 25 YEARS

**Ask About New Cleaner BEFORE CHROME**

**NATROLIN**  
TRADE MARK

**"B-4 CHROME" CLEANER**

(Sample FREE)

**SULPHUR PRODUCTS CO.**

**Greensburg, Pa.**

(The "*Liquid Sulphur*" People)



**F**OR more than a third of a century Wyandotte has been manufacturing superior metal cleaning compounds. And from the very beginning our aim has been to provide you with the most efficient metal cleaning for every dollar you spend.

Because of our research, in the laboratory and in the field—Wyandotte quality is higher than ever before. The result is that the cost of using Wyandotte is lower.

Along with Wyandotte products goes Wyandotte service . . . trained metal cleaning specialists are ready to put their time and experience at your disposal without obligation.

Why not write to us today? We will have the Wyandotte Service Representative in your district call on you at once. Together you can work out a metal cleaning schedule that will save you time, money and trouble in 1940.



# HALL-MARK

*"a mark or proof of quality"*

AND so in buffs as in Gold and Silver—The *Hall-mark* attests the quality.

The Williamsville A1 Stamp is a guarantee of superior materials and workmanship.

## BUY WILLIAMSVILLE BUFFS

### Louis M. Hague

Louis M. Hague, who has recently become vice-president in charge of sales for Hanson-Van Winkle-Munning Co., Matawan, N. J., assumes his new position with broad experience in the plating field both in production and sales.

After graduation from Lafayette College, Mr. Hague entered the production department of the Rome Wire Co. (now General Cable Corp.), Rome, N. Y. From here he went with the firm of Walter E. Hague & Son, Inc., Pittsburgh, electroplaters, where he worked in production,



Louis M. Hague

purchasing and sales, eventually becoming vice-president. In 1928, Mr. Hague went with Hanson-Van Winkle-Munning Co., and for the past eleven years has covered a wide range of operations in various territories including charge of sales at Pittsburgh, district manager at Cleveland, assistant sales manager at Matawan, special sales work in all territories, in charge of sales of buffs, compositions and finishing supplies.

Mr. Hague is a resident of Rumson, N. J., is active in municipal and social affairs in that community, and is a member of various clubs and associations both within and outside the plating industry.



## Verified Business Items

### Courses in Electroplating

The Institute of Electrochemistry and Metallurgy, 59-61 East Fourth Street, New York City, will offer specialized courses in the field of electroplating and metallurgy during 1940. Registration will be held from February 5 to 9 inclusive and the first meeting of the courses will take place on February 7. The following studies will be offered:

#### Electroplating II

This course is designed to give the electroplater a knowledge of the ways and means of obtaining better deposits by applying the latest scientific methods of electrochemistry to electroplating. One hour of each evening will be devoted to a lecture on the theoretical aspects of the subject and three hours will be spent in the laboratory where the student will apply the principles set forth in the lecture. Copper, nickel, zinc, cadmium, chromium, silver, and brass will be deposited from aqueous solutions. While plating the above metals, the factors governing the character of the deposit such as current density, temperature, pH, etc. will be noted. Other experiments will include throwing power, single electrode potential, addition agents, resistance of solutions, anodizing and coloring aluminum, corrosion tests, etc. After these are complete the student will prepare standard solutions and make analyses of all the important constituents of the above plating baths. Tuesday and Wednesday, 7-11 P.M. Spring term. Prerequisite: Electroplating I or its equivalent. Dr. Young and Mr. Klinse-  
vich.

#### Research II

This course is designed to give the practical electrochemist a chance to investigate problems in his field. One half hour per week is devoted to a conference with the instructor in which the method of attack is laid out. The remaining time is spent in the laboratory where the student applies the knowledge and technique to the solving of problems which arise in such an investigation. Tuesday and Wednesday, 7-11 P.M. Spring term. Dr. Young.

#### Industrial Microscopy

Industrial Microscopy I is specially planned in photomicrographical analysis, general microscopy, and instruction on the metallographic microscope. Subjects covered include the preparation of material and the proper selection of optical equipment, methods of illumination, control of glare, illumination by incident light, and the use of color filters, special methods of particle-size determination, determination of refractive index, micrometry, and the proper use of mounting media with respect to its relative refractive index.

# CHROMIC ACID

Recognized as the world's largest manufacturer of chromium chemicals, Mutual brings to the plating industry a basic source of chromic acid.

Our facilities cover every step in its production, from the mining of the chrome ore on a remote island in the Pacific to the wide distribution of the finished product through warehouse stocks in the principal consuming centers.



CHROMIC ACID  
OXALIC ACID  
BICHROMATE OF SODA  
BICHROMATE OF POTASH

Mines in New Caledonia  
Plants at Baltimore and Jersey City  
Warehouse stocks carried in all principal cities.

## MUTUAL CHEMICAL CO. OF AMERICA

270 Madison Avenue, New York City

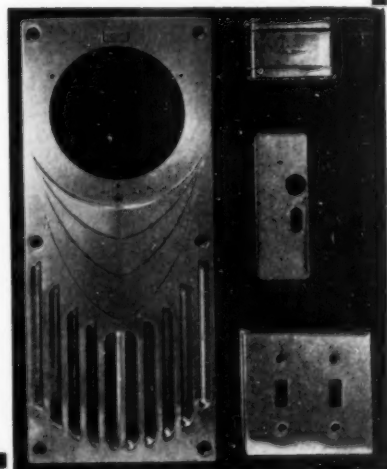
## BORN THE HARD WAY!!

The ability of American Bonded Metals to meet the grueling process of stamping . . . to take difficult, intricate forms—their uniformity of finish and superior drawing and etching properties has placed them first in their field for this use. Completely pre-finished for greater production speed and economy. No plating—before or after fabrication. No polishing. No buffing. Available in a size and weight to meet your requirements. Write on your company letterhead for a new brochure covering the latest in pre-finished metals, designs, patterns and applications.

AMERICAN NICKELOID COMPANY

8 SECOND ST.—PERU, ILLINOIS

Sales Offices in All Principal Cities



# CUT PLATING COSTS

## WITH THIS NEW Longer-life RACK COATING



DEVELOPED by United Chromium, through extensive research, "Unichrome" Rack Coating-W possesses the following outstanding advantages:

1. Withstands boiling cleaners and all plating solutions.
2. Tough—withstands wear and tear of normal handling.
3. Contains no ingredients harmful to any plating solution.
4. Cuts costs—by greatly reducing the frequency of recoatings.
5. Easy to apply—by "dip and force-dry" method.
6. Light in color—easy to see how completely the rack is covered.
7. Any part of rack can be recoated without necessity of recoating entire rack.

Thoroughly proved in actual service—and now regularly used by many plating shops—this new rack coating material has produced amazingly fine results. Reports show that some racks coated with this

material have gone through over 1,000 plating cycles without any insulation breakdown.

Write for Bulletin No. 27  
containing complete information

Platers without rack dipping and drying facilities may have their racks coated with "Unichrome" Rack Coating-W by making arrangements with Chromium Corporation of America, 4645 West Chicago Ave., Chicago, Ill., or Lea Manufacturing Co., Waterbury, Connecticut.

## UNITED CHROMIUM INCORPORATED

51 East 42nd Street, New York, N.Y.  
2751 E. Jefferson Ave., Detroit, Mich.  
Waterbury, Conn.

Trade Mark  
Reg. U.S. Pat. Off.



## KREIDER Centrifugal DRYER

For Drying All Types of Plated Work  
and Lacquering Small Parts

Speeds Up Production . . . Cuts Costs . . .  
Improves Quality



The new Kreider Centrifugal Dryer reflects our many years' experience in this field. It is the result of our engineers' effort to produce the best. Although unusually simple in design and easily operated by one man, the Kreider Dryer speeds up production and improves the quality of the work.

An auxiliary steam heating unit can be supplied as standard equipment when drying parts which have a tendency to retain water and additional steam is needed in the drying operation. Reversing drum switch is supplied on all dryers.

Write for Complete  
Specifications and Prices

DELLINGER MANUFACTURING CO.

727 North Prince Street  
Lancaster, Pa.

Work with the polarizing microscope may also be arranged. Mr. Shillaber. Tuition and laboratory fees, \$55.00. Hours to be announced.

Time payments may be arranged, if desired.

For further information call Dr. C. B. F. Young at ORchard 4-1778 or FLushing 9-1685.

Wheelco Instruments Co., 1929 S. Halsted St., Chicago, Ill., has appointed the Rodgers Engineering Co., 204 Thomas Bldg., Dallas, Tex., as its representative for the North Texas territory with Dallas as headquarters.

Holo-Krome Screw Corp., Brooks St., Elmwood, Hartford, Conn., socket head screws, socket wrench sets, etc., has let contract for two one-story additions, 66 x 123 ft., and 16 x 65 ft. respectively. Cost over \$50,000 with equipment. The principal metal used is steel.

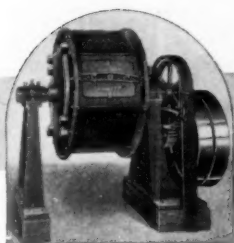
Noma Electric Corp., 524 Broadway, N. Y., electric lamps and other electrical specialties, has purchased a nine-story building at 55-61 W. 13th St., about 100,000 sq. ft. floor space, for plant, removing from first noted location and providing large increased capacity. The following departments are operated: stamping, soldering, and lacquering. Principal base metals used are brass and steel.

Chicago Pneumatic Tool Co., 1241 E. 49th St., Cleveland, Ohio, has let contract for a two-story addition 30 x 150 ft. The firm operates the following departments: stamping, welding, grinding, sand blasting, polishing, degreasing, cleaning, tumbling, burnishing, buffing and lacquering. Principal base metals used: brass, steel, bronze and aluminum.

General Electric Co., Schenectady, N. Y., has let contract for a new six and seven-story and basement factory branch, storage and distributing plant at Chicago, to total 363,000 sq. ft. of floor space. Cost over \$1,500,000 with equipment.

The Porcelain Enamel & Mfg. Co., Eastern and Pemco Aves., Baltimore, Md., announces the promotion of Donald S. Beal to the position of sales representative in the Chicago territory. Mr. Beal was previously service engineer in the Chicago territory for Pemco. He was graduated from Whitworth College in Spokane, Wash., with a B.S. degree, and has been connected with the ceramics industry since 1929. His headquarters will be at 250 Vandiman Ave., Glenn Ellyn, Ill.

Aeronautical Corp. of America, Inc., Lunken Airport, Cincinnati, Ohio, monoplanes and other types of aircraft, parts, etc., will take bids on general contract for a new building for storage of airplanes with about 48,000 sq. ft., at a cost (with equipment) of approximately \$175,000. The following departments are operated: drawing, spinning, stamping, brazing, welding, grinding, cleaning, lacquering and finishing. Principal base metals used are steel, bronze and aluminum.



## Barrel Finishing

earns profits **3** ways

- 1** Work hardens the surface of small metal parts, increasing wear resistance.
- 2** Closes the pores in the metal, increasing resistance to corrosion.
- 3** Produces brilliant finish on plated and unplated parts.

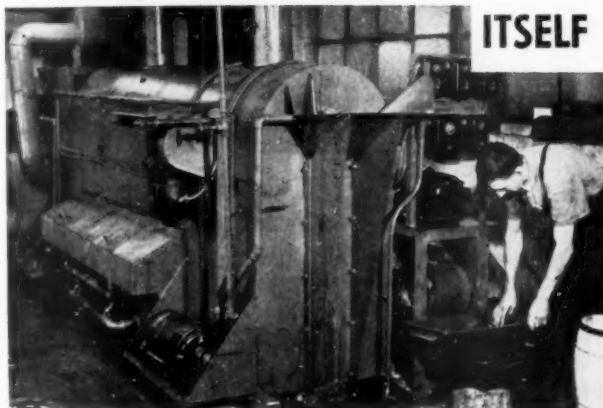
Write today  
for  
complete  
information

**The Abbott Ball Company**

1046 New Britain Ave.

Hartford, Conn.

## This Wash, Rust-proof and Dry Machine PAYS for ITSELF IN A YEAR



A nationally prominent bolt and nut manufacturer reports:

"Since installing the Ideal Continuous wash, rust-proof and dry machine for metal parts, it has saved sufficiently to pay for itself in one year's operation. The work is finished better than with older methods, and at greater speed and considerably lower manufacturing cost."



This is one of our standard wash, rust-proof and dry machines, consisting of soaking wash, spray wash, drain, oil spray, drain and dry. Will handle 900 lbs. of product per hour. For details of this and other Ransohoff Equipment, write for Catalog 40.

N. RANSOHOFF, INC. • 202 W. 71st Street, Carthage • CINCINNATI, OHIO



# FELT

*holds its flat*  
**SURFACE**

Ask your  
supplies  
salesman  
for  
**PARAMOUNT  
BRAND**

Note surface and edges of this Paramount Felt Polishing Wheel after many months service. No flabby edges, no spreading seams. Felt is the only wheel that won't spread and cause streaky polishing. Felt wheels eliminate frequent reheading.

**Bacon Felt Co.** ESTABLISHED 1824  
WINCHESTER MASS.

*Electroloy Co.*, 50 Church St., N. Y., has leased a portion of the Bridgeport, Conn., plant formerly occupied by International Silver Co., and owned by the Stanley Works, Inc., to engage in the manufacture of resistance welding electrodes. R. H. Taylor is president and manager.

*Electric Auto-Lite Co.*, Champlain and Mulberry Sts., Toledo, Ohio, automotive starting and lighting equipment, etc., has asked bids on general contract for a one-story addition to the branch plant at Port Huron, Mich., including improvements in present works. Cost over \$50,000 with equipment. Departments operated: pickling, spinning, stamping, soldering, brazing, welding, grinding, sand blasting, polishing, degreasing, cleaning, plating, tumbling, burnishing, buffing, coloring, lacquering, enameling and finishing. Principal base metals used: brass, steel, nickel silver, zinc, aluminum and lead.

*Rustless Iron & Steel Corp.*, 3400 E. Chase St., Baltimore, Md., has approved plans for two large one-story additions, to be equipped for a rolling mill and as a grinding division, respectively, in connection with other new plant units now in progress on Edison Highway. Entire project will cost about \$1,000,000 with equipment. The principal base metal used is steel.

*United Aircraft Corp.*, East Hartford, Conn., has approved plans for an addition to the present engine factory in East Hartford, increasing the manufacturing facilities of the Pratt & Whitney Aircraft Division. The new addition will be built on the Willow St. side, and will be 274,000 sq. ft., costing approximately \$1,000,000. The following departments are operated: welding, grinding, sand blasting, descaling, polishing, degreasing, cleaning, plating, anodic treatment, lacquering, enameling and finishing. Principal base metals used are: steel and aluminum.

*General Electric Co.'s* lamp department has acquired about 12 acres on U. S. Highway No. 80 in southern district of Jackson, Miss., for the production of G. E. Mazda sealed beam automobile headlamps. These are of new construction in which light source is hermetically sealed in a headlamp made entirely of glass. The plant will consist of two main one-story buildings having about 100,000 sq. ft. of floor space, with several auxiliary structures, power house and other mechanical departments. Equipment will be provided for a working force of about 350 persons. Cost close to \$750,000 with machinery.

*Talon, Inc.*, slide fastener manufacturers of Meadville, Pa., have opened an assembly plant at 762 E. Pico St., and a stock and service plant at 702 S. Los Angeles St., Los Angeles, Calif.

*Norris Stamping & Manufacturing Co.*, Los Angeles, Calif., has completed a \$50,000 expansion program involving the acquisition and equipping of a neighboring building at 617 Gage Ave., which provides the firm with 13,000 sq. ft. of additional floor space.



Non-Corrosive Products Co., Huntington Park, Calif., have plans under way for building a new plant to expand their manufacture of pipe-wrapping machinery, centrifugal casting machines to line water pipe with hot bitumen and other products. The firm also repairs and renews steel tanks.

### Electroplating Digest

(Concluded from page 33)

additional virtues that it is cheap, easily soluble in water and non-toxic. It is therefore recommended that all alkaline cleaning solutions for use on tinned equipment should contain a suitable amount of sodium sulphite. This is conveniently arranged by mixing 10% to 20% by weight of sodium sulphite with the solid detergent before making up the cleaning solution.

Several proprietary cleaners are now on the market which embody the sodium sulphite additions; these can be confidently recommended for cleaning tinned copper or tinned steel equipment with the minimum of damage to the tin coating.

Even when a sulphite-containing cleaner is employed, care should be exercised in cleaning, as tin is a relatively soft metal. Dairy equipment, for example, should first be washed with cold water to remove as much milk as possible, and the cleaner should then be applied in accordance

with the makers' instructions, giving special attention to the following points:—  
Take care not to aerate the solution and see that it is really hot.

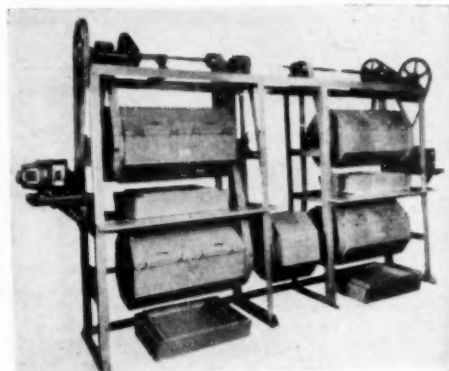
Brushing must only be done with bristle brushes, as wire brushes and scrapers are highly destructive; scouring powders should also be avoided.

After cleaning it is important to ensure that the equipment dries quickly.

In some districts a hard scale may form which should be removed by a proprietary cleaner consisting of an acid, such as phosphoric acid, and an inhibitor. This solution should not be used any more than is strictly necessary. If the water supply is excessively hard an alkaline cleaner containing hexameta-phosphate, or one of the proprietary cleaners containing a colloid, will be found useful.

### INVESTIGATE LUPOMATIC POLISHING PROCESS!

When you make a LUPO-MATIC installation, you polish, cut down and color metal parts in mass production and produce a finish equal to what it is possible to accomplish by the hand buffing method.



Type S, No. 10-S-M 5 Tumbler Unit

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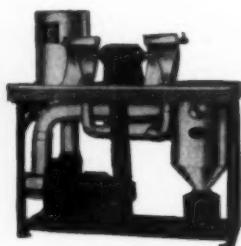
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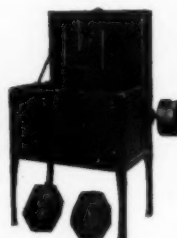
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# Supply Prices, December 29, 1939

## Anodes

Prices, except silver, are per lb. f.o.b., shipping point, based on purchases of 2,000 lbs. or more, and subject to changes due to fluctuating metal markets.

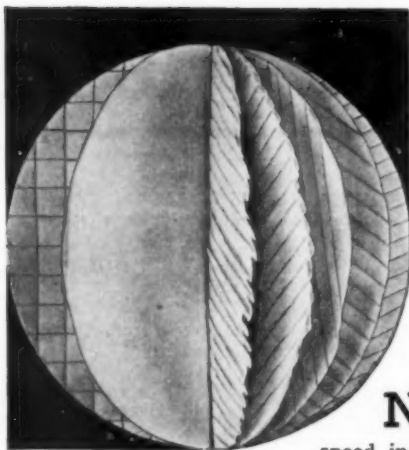
COPPER: Cast	22 $\frac{3}{4}$ c. per lb.	NICKEL: 90-92%, 16" and over	.45 per lb.
Electrolytic, full size, 17 $\frac{3}{4}$ c.; cut to size	17 $\frac{3}{4}$ c. per lb.	95-97%, 16" " "	.46 per lb.
Rolled oval, straight, 17 $\frac{3}{4}$ c.; curved	18 $\frac{3}{4}$ c. per lb.	99%+cast, 16" and over, 47c.; rolled, depolarized, 16" and over, 48c.	
BRASS: Cast	20 $\frac{1}{4}$ c. per lb.	SILVER: Rolled silver anodes .999 fine were quoted from 49c. per Troy ounce upward, depending on quantity.	
ZINC: Cast	11 $\frac{1}{2}$ c. per lb.		

## Chemicals

These are manufacturers' quantity prices and based on delivery from New York City.

Acetone, C.P. l.c.l., drums	lb.	.06 $\frac{3}{4}$ -.07 $\frac{3}{4}$	Gum, Arabic, white, powder, bbls.	lb.	.125-.14
Acid, Boric (boracic) granular, 99.5%, bbls.	lb.	.053-.059	Sandarac, prime, bags	lb.	.50
Chromic, 99%, 100 lb. and 400 lb. drums	lb.	.16 $\frac{1}{2}$ -.17 $\frac{1}{4}$	Hydrogen Peroxide, 100 volume, carboys	lb.	.20
Hydrochloric (muriatic) Tech., 20°, carboys	lb.	.027	Iron Sulphate (Copperas), bbls.	lb.	.016
Hydrochloric, C.P., 20°, carboys	lb.	.08	Lead, Acetate (Sugar of Lead), bbls.	lb.	.11-.13 $\frac{1}{2}$
Hydrofluoric, 30%, bbls.	lb.	.07-.08	Oxide (Litharge), bbls.	lb.	.125
Nitric, 36°, carboys	lb.	.06	Magnesium Sulphate (Epsom Salts), tech., bag	lb.	.018
Nitric, 42°, carboys	lb.	.075	Mercury Bichloride (Corrosive Sublimate)	lb.	\$1.58
Oleic (Red Oil), distilled, drums	lb.	.09-.10	Mercuric Oxide, red, powder, drums	lb.	\$2.66
Oxalic, bbls. l.c.l.	lb.	.12-.14	Nickel, Carbonate, dry, bbls.	lb.	.36-.41
Stearic, double pressed, distilled, bags	lb.	.12-.13	Chloride, bbls.	lb.	.18-.22
single pressed, distilled, bags	lb.	.11 $\frac{1}{2}$ -.12 $\frac{1}{2}$	Salts, single, 425 lb. bbls.	lb.	.135-.145
triple pressed, distilled, bags	lb.	.14 $\frac{1}{4}$ -.16	Salts, double, 425 lb. bbls.	lb.	.135-.145
Sulphuric, 66°, carboys	lb.	.025	Paraffin	lb.	.05-.06
Alcohol, Amyl, (Fusel oil, ref'd), l.c.l., drums	lb.	.175	Perchloroethylene, drums	lb.	.08 $\frac{1}{4}$
Butyl-normal, l.c.l., drums	lb.	.095	Phosphorus, red	lb.	.42
Denat., S.D. #1, 190 pf., 1-18 drms, wks.	gal.	.335	yellow	lb.	.55
Diacetone, pure, drums, l.c.l.	lb.	.115	Potash, Caustic, 88-92%, flake, drums, works	lb.	.07 $\frac{1}{4}$ -.075
Methyl, (Methanol), 95%, drums, l.c.l.	gal.	.385-.405	Potassium, Bichromate, crystals, casks	lb.	.09 $\frac{1}{4}$
Propyl-Iso, 99%, l.c.l., drums	gal.	.41	Carbonate (potash) 98-100%, drums	lb.	.06 $\frac{1}{2}$
Propyl-Normal, drums	gal.	.70	Cyanide, 94-96%, cases	lb.	scarce
Alum, ammonia, granular, bbls., works	lb.	.035	Pumice, ground, bbls.	lb.	.03
Potash, granular, bbls., works	lb.	.0375	Quartz, powdered	ton	\$30.00
Ammonia, aqua, 26°, drums, carboys	lb.	.02 $\frac{1}{2}$ -.05 $\frac{1}{4}$	Quicksilver (Mercury) 76 lb. flasks	flask	\$90.00
Ammonium, chloride (sal-ammoniac), white, granular, bbls.	lb.	.0521-.075	Rochelle Salts, crystals, bbls.	lb.	.21 $\frac{1}{4}$
Sulphate, tech., bbls.	lb.	.035-.05	Rosin, gum, bbls.	lb.	5.25-7.75
Sulphocyanide (thiocyanate), pure, crystal, kegs	lb.	scarce	*Silver, Chloride, dry, 100 oz. lots	oz.	.32
Sulphocyanide (thiocyanate), com'l, drums	lb.	"	Cyanide, 100 oz. lots	oz.	.33 $\frac{1}{2}$
Antimony Chloride (butter of antimony), sol., carboys	lb.	.19 $\frac{1}{2}$	Nitrate, 100 oz. lots	oz.	.27
Barium Carbonate, ppted., l.c.l., bags, works	lb.	.03	Sodium, Carbonate (soda ash), 58%, bbls.	lb.	.0235
Benzene (Benzol), pure, drums, works	gal.	.21	Cyanide 96%, 100 lb. drums	lb.	.15
Butyl Lactate, drums	lb.	.225	Hydroxide (caustic soda) 76%, flake	lb.	.0355
Cadmium Oxide, l.c.l., bbls	lb.	.80	Hyposulphite, crystals, bbls.	lb.	.035-.065
Calcium Carbonate (Ppted. chalk), U.S.P.	lb.	.05 $\frac{1}{4}$ -.075	Metasilicate, granular, bbls.	lb.	.0335
Carbon Bisulfide, l.c.l., 55 gal. drums	lb.	.05 $\frac{1}{4}$ -.06	Nitrate, tech., bbls.	lb.	.029
Carbon Tetrachloride, l.c.l., drums	gal.	.73	Phosphate, tribasic, tech., bbls.	lb.	.0295
Chrome, green, commercial, bbls.	lb.	.22	Pyrophosphate, anhydrous, bbls., l.c.l.	lb.	.0580
Chromic Sulphate, drums	lb.	.26 $\frac{1}{4}$	Sesquisilicate, drums	lb.	.0425
Cobalt Sulphate, drums	lb.	.65	*Stannate, drums	lb.	.36 $\frac{1}{2}$ -.38 $\frac{1}{2}$
*Copper, Acetate (verdigris), bbls.	lb.	.25	Sulphate (Glauber's Salts), crystals, bbls., works	lb.	.0135
Carbonate, 53/55%, bbls.	lb.	.17	Sulphocyanide, drums	lb.	.30-.35
Cyanide, Tech., 100 lb. bbls.	lb.	.34	Sulphur, Flowers, bbls., works	lb.	.037-.0410
Sulphate, Tech., crystals, bbls.	lb.	.05 $\frac{1}{4}$	*Tin Chloride, 100 lb. kegs	lb.	.39
Cream of Tartar (potassium bitartrate), crystals, kegs	lb.	.26 $\frac{1}{4}$	Toluene (Toluol), pure, drums, works	gal.	.27-.30
Crocus Martis (iron oxide) red, tech., kegs	lb.	.07	Trichlorethylene, drums	lb.	.08 $\frac{1}{4}$
Dibutyl Phthalate, l.c.l., drums	lb.	.195	Tripoli, powdered	lb.	.03
Diethylene Glycol, l.c.l., drums, works	lb.	.155	Wax, Bees, white, bleached, slabs 500 lbs.	lb.	.40-.44
Dextrine, yellow, kegs	lb.	.05-.08	Bees, yellow, crude	lb.	.29-.31
Emery Flour (Turkish)	lb.	.07	Carnauba, refined, bags	lb.	.50-.55
Ethyl Acetate, 85%, l.c.l., drums	lb.	.07	Montan, bags	lb.	.26-.30
Ethylene Glycol, l.c.l., drums, works	lb.	.17-.20	Spermaceti, blocks	lb.	.26-.27
Flint, powdered	ton	30.00	Whiting, Bolted	lb.	.025-.06
Fluorspar No. 1 ground, 97-98%	ton	\$60.00	Xylene (Xylol), drums, works	gal.	.31-.32
Fusel Oil, refined, drums	lb.	.125-.14	Zinc, carbonate, bbls.	lb.	.17-.18
*Gold, Chloride	oz.	\$18 $\frac{1}{4}$ -.23	Cyanide, 100 lb. kegs	lb.	.33
Cyanide, potassium 41%	oz.	\$15.45	Chloride, granular, drums	lb.	.06
Cyanide, sodium 46%	oz.	\$17.10	Sulphate, crystals, bbls.	lb.	.04

\*Subject to fluctuations in metal prices.



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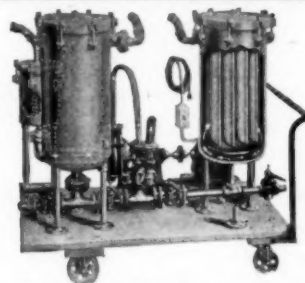
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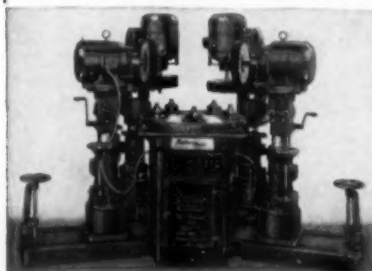
Cut illustrates both closed and internal view of typical filter.

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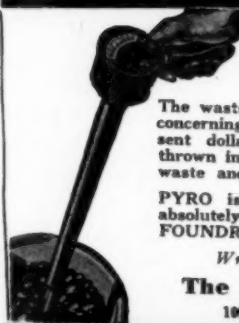
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Write for illustrated bulletin No. 110

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# ORGANIC FINISHING

SECTION OF METAL INDUSTRY

JANUARY, 1940

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## Purchasing of Finishing Materials

Much has been said—but seldom written—on the un-fair manner in which organic finishing materials are some-times purchased. Among other things, those responsible for purchases have been variously accused of favoritism, lack of knowledge, downright stupidity, and even of accepting bribes. We cannot believe that all this is true. In the first place, competition in any field does not tolerate for long the stupid individual or the one who is open to commercial bribery. There are too many capable and honest men who are ready to take their places. Furthermore, so much exact informa-tion about finishing is available that lack of knowledge can scarcely be blamed when a particular material is chosen. For the same reason, neither can a favorite withstand the pressure of cold, hard facts concerning quality and cost.

It is our belief that organic finishing materials are pur-chased largely on a sound basis. This must be true if the method followed by organizations which operate economical and satisfactory finishing departments is any indication. Our contention is borne out by the number of such organizations.

In every case, the first question about any finishing material concerns quality. To be considered for a new ap-plication, or to be competitive with a material already in use, standards of durability and appearance must be met. In other words, the material must be capable of satisfactory service in the field. The second point is cost. After quality, the cost per unit finished must be considered, with special attention to the possibility for economy. Next, there is per-formance in production. Difficulty in handling the material, the necessity for extra equipment or special methods—these are definitely factors in the choice of a finishing material. Last, but certainly not least, are service, dependability and confidence. While it may be difficult to place a quantita-tive value on these, they are important in making final decisions.

The formula for selecting an organic finishing material is not involved. Strict attention to facts and values plus an appreciation of the problem are all that are necessary. In following this formula there can be nothing but satisfaction for all concerned.

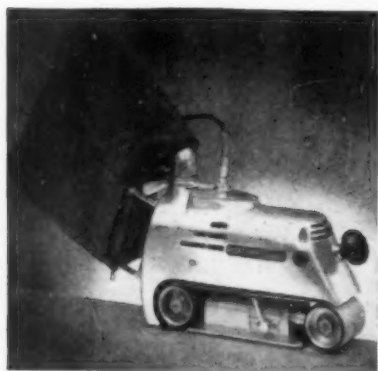
# Technical Developments of 1939 in Supplies

By Dr. Walter R. Meyer

Editor

## Surfacing Equipment

Several unique portable grinding, sanding and polishing machines were announced during the year. A light weight portable electric sander<sup>1</sup> weighing 9 lbs. has been introduced to the trade for surfacing and refinishing of all types of surfaces for painting and other organic finishing. It can also be used for light grinding of straight grain metal and for sharpening hand tools.



New model sander-grinder.<sup>2</sup>

A high belt speed portable sander-grinder<sup>2</sup> with an efficient dust collecting system to make the operation practically dustless, has also been introduced.

An all-electric portable sander<sup>3</sup> having a reciprocating motion has been developed. It is said to be adaptable to finishing on flat, curved and irregular surfaces. It can be used for sanding, rubbing or polishing.

Grinding tools have also undergone development, including a new type of portable grinder<sup>4</sup>, powered by an induction type motor with no commutator, brushes or gears and only two bearings. This machine is recommended for heavy duty grinding and sanding, and each size is said to be

capable of 100% overload momentarily.

Improvements have been made in pneumatic sanding drums<sup>5</sup>, which include a new style fabric band and air tube. New drum construction allows for faster removal of abrasive bands and easier servicing.

## Degreasing Equipment

The developments in solvent and vapor degreasing have been chiefly mechanical with the view of obtaining more thorough removal of solid dirt as well as organic dirt. Wider use of continuous solvent distilling systems for keeping clean degreasing fluid has been made. New designs of rotating basket type degreasers<sup>6, 7</sup> have been marketed for cleaning cup-shaped objects with a minimum loss in solvent.

A line of portable degreasers<sup>8</sup> has been announced, these degreasers being electrically heated and the solvent level maintained by thermostatic adjustment on the heating element. The absence of circulating cooling water makes them adaptable for ready transfer to various jobs.

Improvements in steam vapor spray cleaning<sup>9</sup> have included the use of

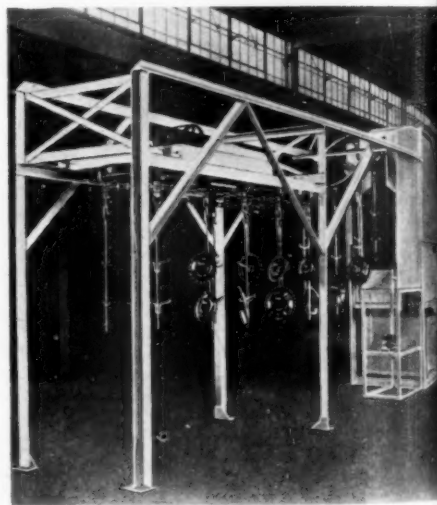


Portable degreasing unit.<sup>8</sup>

pressure atomizing fuel oil burners and heating coils.

## Metal Treatment Processes for Finishing

Progress has been made in the development of materials and treating processes to insure better adhesion of organic coatings to active metals, such as magnesium and zinc. A material called "Galv-A-Niel"<sup>10</sup> has been announced for treating zinc coatings to insure adhesion of paints and other organic finishes. The material is applied from a water solution to the work by brushing, spraying or dipping.



One-dip type degreaser with solvent still and

Another process for treating surfaces of zinc before finishing involves the application of a solution by dipping or wiping, called "Zinsol"<sup>11</sup>, which is stated to cause the formation of an alloy consisting of zinc and another metal and being inert to moisture, atmosphere and organic finishes generally, forms a stable foundation for the applied finish.

New coatings for the treatment of magnesium alloys<sup>12</sup> have also been described. A new kind of galvanized sheet metal<sup>13</sup> with a special phosphate coating bonded with zinc has been marketed for outdoor use to insure greater paint adhesion.

# and Equipment for Organic Finishing

## Primers

A growing interest has been shown in the use of zinc dust—zinc oxide paints<sup>14</sup> for primer and finish coats on untreated galvanized iron.

Good adhesion and weather-resistant qualities together with high hiding power, make such paints practical for one-coat application for new and re-paint work on galvanized structures. A primer<sup>15</sup>, for metal exterior and interior work, of synthetic resin—chinawood oil vehicle, with zinc chromate as the only prime pigment, has been developed as a base for synthetic paints and enamels.

A spar varnish vehicle<sup>15</sup> pigmented with iron oxide and zinc chromate has been announced as an anti-rust primer for exterior and interior metal work for painting over rusty surfaces difficult to reach for cleaning.

A primer<sup>16</sup> is available, which is reported, to penetrate into the surface surrounding each rusty particle and prevent further oxidation.

Numerous fast drying synthetic enamels, available in various colors, have been developed during the year. One enamel, for example, is said to set in 20 minutes and dries to touch in 45 minutes<sup>15</sup>, thus being particularly suitable for applications where production must be out in 24 hours, and baking facilities are not available.

The developments in low baking synthetic enamels<sup>11,15,17,18,19</sup> have been many. The baking schedule for one enamel announced is 15 minutes at 250°F.; 30 minutes at 225°F.; 1 hour at 200°F., and 2 hours at 175°F.

Where proper oven facilities are available, new quick-bake synthetic enamels are offered which can be baked with times from fifteen minutes<sup>11</sup> to twenty minutes<sup>15</sup>. These finishes are porcelain-like, glossy, tough, hard and mar-proof with good adhesion and resistance to attack by various chemicals, such as gasoline, liquor, etc.

Enamels developed for special purposes have been many. These include

a red oxide dipping enamel<sup>15</sup> for coil springs and other wire; an enamel for application to turned wooden parts by tumbling with which solid hiding is obtained by three tumble coats; baking enamels for reproducing colored finishes on metals and which will resist cleaning and plating operations enabling two-color finish<sup>11</sup> effects to be obtained.

## Stripping of Enamels

Strippers<sup>20, 21</sup> for quickly removing baking enamels without attack on metals, including zinc and aluminum, have been marketed during the year.

## Special Finishes

Finishes for special purposes or special effects announced, include a one-coat metal finish<sup>22</sup> that dries rapidly and adheres tenaciously to Dural with good atmospheric corrosion resistance, which has been developed for airplanes.

Special aluminum coatings<sup>23</sup> were developed which have high reflectivity with a silver-like appearance. Quick-drying ready mixed aluminum paints<sup>16</sup> were also made available. Wider use and special effects with wrinkle finishes<sup>11, 24</sup> were developed. A semi-glossy baking japan<sup>15</sup> with a rich, black finish for small motor parts, metal buttons, etc., was included among the many developments in baking japans.

Two-tone effects were made possible in one-spray application with a material available in a wide variety of colors<sup>22</sup>.



Forced-draft cooled portable spraying equipment.<sup>27</sup>

Special finishes presented to the trade also include a mar-proof, hammered effect finish<sup>25</sup>, designed especially for use on rough or porous metals. It is said to be particularly good to cover defects in the metal, such as scratches, weld marks, etc.

A new process copper powder<sup>26</sup> was announced for which it was claimed that when used with high bake synthetic vehicles, a finish closely imitating that of copper plate can be produced.

Difficulty with brushing or blooming of nitrocellulose lacquers during drying on humid days was stated to be overcome by a new lacquer retarder<sup>20</sup>.



Streamlined spray gun with self-contained oil and moisture filter.<sup>28</sup>

## EQUIPMENT

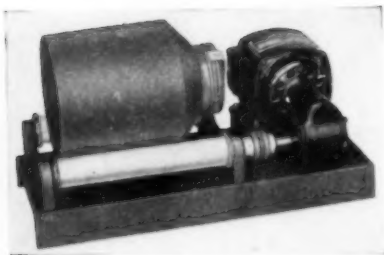
### Spray Guns

Most of the leading manufacturers of spray equipment introduced new models or innovations to their present models. Spray guns announced included a streamlined automatic spray gun<sup>27</sup>, stated to eliminate dripping and spitting; a gun with self-contained oil and moisture filter<sup>28</sup> and a gun with a hollow air atomizing head with a wide range of capacities<sup>29</sup> for spraying. A gun designed to serve the needs of industrial decorative work from the drawing of a fine pencil line to the laying of a broad, soft spray, was recently announced<sup>30</sup>.

### Spraying Units

Improvements and new designs in both portable and stationary units in-





Jar mill.<sup>40</sup>

clude: a direct-drive spraying outfit<sup>30</sup>; a unit with two powerful fans for ventilation to prevent overheating of the compressor<sup>27</sup>; and a diaphragm tank compressor<sup>28</sup>, ideal for artists' air brush work and other low volume air pressure work.

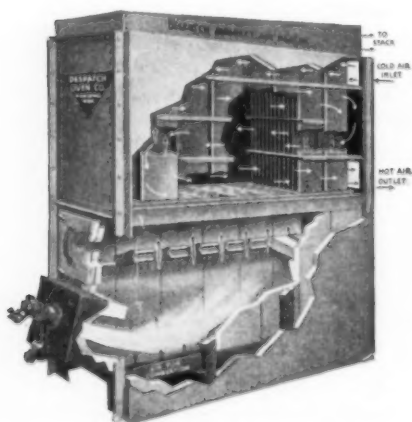
#### Automatic Finishing Equipment

Unique equipment has been designed for diverse types of coating problems. These include a machine<sup>31</sup> for semi-automatic spray coating of the inside of small cylindrical objects, such as paper or metal cans; a versatile machine for spraying golf balls, clocks, etc. which sprays only when the gun is following the revolving products to be finished<sup>27</sup>; an automatic air painting unit<sup>32</sup> for coating 1800 metal tile square per hour; and a unit for finishing can tops at the rate of 300 per minute.

#### Oven Equipment

During the year, a novel direct gas-fired externally mounted air heater employing a controlled combustion feature was offered to the trade for heating operations from 100°F. to 1250°F. The heaters are said to combine high operating efficiency, flexibility, safety and cleanliness<sup>33</sup>.

An indirect air heater<sup>33</sup> for gas or oil heat for ovens, driers and space



Phantom view of heater.<sup>33</sup>

heating, was designed to eliminate maintenance and replacement of parts.

Chain lubrication for high temperature ovens is stated to be effectively done by a new form of colloidal graphite<sup>34</sup>.

#### Miscellaneous Equipment

A line of Alzak aluminum reflectors to be used with 250 watt drying bulbs has been offered for drying of enamels or paints by radiant energy<sup>35</sup>.

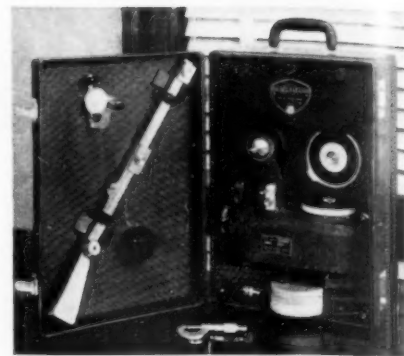
The reproducible and accurate evaluation of the wear resistance of organic coatings was made possible by the design of new abrasion testing equipment<sup>36</sup>. Other new equipments offered include: a fast flowing, non-dripping dispensing faucet<sup>37</sup>; several designs of air motored mixers<sup>31</sup>; a new centrifugal for centrifugal enameling<sup>38</sup>; siphon feed covers for cans which obviate the necessity for using separate material cups for each change of color<sup>39</sup>; new jar mills for grinding and pulverizing of pigments<sup>40</sup>; a propeller type blower with the blower housing entirely out of the air stream to eliminate corrosion and fire hazards<sup>41</sup>, and three spray booth compounds for facilitating rapid cleaning of spray booths<sup>11, 42, 43</sup>.



New dispensing faucet.<sup>37</sup>

#### Company References

1. Syracuse Guild-Tool Co., Syracuse, N. Y.
2. Porter-Cable Machine Co., Syracuse, N. Y.
3. Detroit Surfacing Machine Co., 7433 W. Davison St., Detroit, Mich.
4. Gaston Power Tools, 2657 W. 95th St., Evergreen Park, Chicago, Ill.
5. Mall Tool Co., 7740 S. Chicago Ave., Chicago, Ill.
6. Detroit Rex Products Co., 13005 Hillview Ave., Detroit, Mich.
7. G. S. Blakeslee & Co., 19th St. & 52nd Ave., Cicero Sta., Chicago, Ill.
8. Phillips Mfg. Co., 350 W. Huron St., Chicago, Ill.
9. Homestead Valve Mfg. Co., Coraopolis, Pa.
10. Mar-Nel Chemicals, Redford Sta., Detroit, Mich.
11. Maas & Waldstein Co., Newark, N. J.
12. The Dow Chemical Co., Midland, Mich.
13. American Rolling Mill Co., Middletown, Ohio.
14. The New Jersey Zinc Co., 160 Front St., New York, N. Y.
15. Hilo Varnish Corp., 42-60 Stewart Ave., Brooklyn, N. Y.
16. The American Asphalt Paint Co., 43 E. Ohio St., Chicago, Ill.
17. Finishes Division, E. I. du Pont de Nemours & Co., Inc. Rm. 7156, du Pont Bldg., Wilmington, Del.
18. The Zapon Company, Stamford, Conn.
19. Impervious Varnish Company, Rochester, Pa.
20. The Enthone Company, 442 Elm St., New Haven, Conn.
21. Estox Products Co., New Haven, Conn.
22. The Glidden Co., Cleveland, Ohio.
23. Special Chemicals Corp., 30 Irving Place, New York City.
24. New Wrinkle, Inc., Dayton, Ohio.
25. Ault & Wiborg Corp., 76 Varick St., New York, N. Y.
26. The Edward C. Ballou Co., 6 Varick St., New York City.
27. The Binks Mfg. Co., 3114-40 Carroll Ave., Chicago, Ill.
28. Electric Sprayit Co., 220 N. Broadway, Milwaukee, Wisc.
29. The Alexander Milburn Co., 1416-1428 W. Baltimore St., Baltimore, Md.
30. DeVilbiss Co., Toledo, Ohio.
31. The Eclipse Air Brush Co., Inc., 390 Park Ave., Newark, N. J.
32. Paasche Airbrush Co., 1909 Diversey Parkway, Chicago, Ill.
33. The Despatch Oven Co., Minneapolis, Minn.
34. Acheson Colloids Corp., 2150 Washington Ave., Port Huron, Mich.
35. The Edwin F. Guth Co., 2615 Washington Ave., St. Louis, Mo.
36. Taber Instrument Co., North Tonawanda, N. Y.
37. The Imperial Brass Mfg. Co., 1200 W. Harrison St., Chicago, Ill.
38. Tolhurst Centrifugal Division, American Machine and Metals, Inc., East Moline, Illinois.
39. Burning Brand Co., 1400-16 W. Fulton St., Chicago, Ill.
40. United States Stoneware Co., 60 E. 42nd St., New York City.
41. Hartzell Propeller Fan Company of Piqua, Ohio.
42. Harris Soap Co., Buffalo, N. Y.
43. Wayne Chemical Products Co., Copeland and M.C.R.R., Detroit, Mich.



Abrasion wear testing outfit.<sup>36</sup>

# Developments in Lacquers & Enamels for Industrial Finishing During 1939

By G. Klinkenstein

Vice President and Technical Director,  
Maas & Waldstein Co., Newark, N. J.

The progress that took place in the industrial finishing field during 1939 was very largely in the direction of speeding up the application of high grade finishes in order to reduce production costs.

This movement to eliminate the finishing room as a production bottleneck has been of major importance in the finishing industry for several years. It has, naturally, been of the greatest interest to product manufacturers, and the manufacturers of finishes responded by turning out improvements in "high speed" finishes in rapid succession, while production engineers devised new methods of keeping the stream of products flowing continuously.

## New High-Speed Synthetic Enamels

Prior to 1939, the problem of the high-speed finish was not fully solved. Finishes were available that could be applied very rapidly, but in most cases speed was secured at a sacrifice of durability and appearance, and relatively long baking schedules were required to produce finishes of the highest quality. But in 1939, a line of high-speed synthetic baking enamels was developed which seems to be about the last word in this class of finish. These enamels dry out of dust and bake hard in 5 minutes at 350° F. The resulting finish is exceedingly hard and durable; it is resistant to marring, moisture, and the action of household chemicals; the color retention is excellent; the gloss is lustrous; and paper printing after the product is packed for shipment is eliminated.

These new enamels are supplied for use on all metals and Bakelite, and in all colors, with or without bronze powders. They are especially suitable for use on high-grade steel products subjected to severe service, such as refrigerators, washing machines, kitchen cabinets, etc.

## Hot Lacquer

Hot Lacquer represents another ap-

proach to the problem of speed plus quality.

In the hot lacquer process, lacquer which has been heated to 150° or 160° Fahrenheit electrically, is sprayed on the product with a special gun. Neither the product nor the gun has to be heated, but the gun must be so designed that the lacquer circulates through it without having a chance to cool down.

The object of heating the lacquer is to reduce its viscosity. This permits the use of lacquers having a higher solids content than is possible with lacquers applied cold, and this, in turn, permits the production of thicker films. The increase in the solids content ranges from 25% to 50% and the increase of film thickness may be as high as 100%, so that one coat of hot lacquer may equal two coats of cold lacquer.

The advantages of hot lacquering are, in the first place, a reduction in the finishing time, and secondly, the production of lacquer films that are comparable in build-up with films of synthetic enamels and retain the special advantages of lacquer, namely, rapid drying and hardening, easy sanding and patching, and brilliance and clarity of color.

Experimental work, with the object of getting all of the production conditions for this process under complete control, is still in progress.

## Dip and Spray Wrinkle Enamel

In a recently developed process for applying wrinkle enamel to rough castings, the castings are first dipped in a thin solution of the wrinkle finish, then placed on a rack to drain off the surplus enamel and allow the coating to set and finally sprayed while the coating is still wet.

This process insures complete surface coverage to seal the pores of the casting and cuts down the number of rejects, due to imperfect coverage, by as much as 20 per cent. It also permits the use of rougher castings and

saves from 25% to 40% of the finishing material required.

## Conveyor Finishing

The use of conveyor systems for finishing products is no novelty in large plants, but this type of equipment is now being introduced in increasing numbers in small plants because of the economies made possible.

Conveyor finishing systems vary widely in complexity, depending upon the manufacturing process. Any of the steps of the finishing process may be carried out manually and the remainder handled by the conveyor, or the conveyor may take care of the entire process. In any case, where the system is applicable, there is a saving of time and a greater uniformity of output.

## Infra-Red Baking

A recent development in the baking of finishes is the use of clusters of electric lamps which are low in luminous efficiency but radiate a high per-



Radiant energy dryer.<sup>35</sup>

centage of infra-red rays. Infra-red baking has proved very satisfactory in finishing products with lacquers and quick-drying enamels, such finishes being dried sufficiently to permit handling in 3 minutes and baked hard in 15 minutes.

Advantages claimed for this method of baking are the following: the finish is baked from the inside out, instead of vice versa; the lamps attain maximum efficiency soon after they are turned on, so there is only a very short warm-up period; and they can be conveniently applied to any kind of a conveyor system.

For the great majority of industrial finishes, infra-red baking is still in the experimental stage, but manufacturers are watching developments with great interest.

# Exhaust Booth Design\*

By Theodore Hatch  
and  
Robert B. Northrup

Proper design of exhaust booths for organic finishing ventilation is required to insure health and safety. Factors discussed are: size of booth, rate of ventilation, distributing baffles, exhaust fan and piping, fire prevention and personal respiratory protection.—Ed.

In pneumatic spray painting, the paint or lacquer is broken up into a mist in the spray nozzle and directed toward the object to be coated by means of a high-velocity air stream.

A certain amount of the mist does not reach the surface but is scattered in the atmosphere. In addition, some of the droplets rebound from the painted surface with the conveying air and thus add to the atmospheric contamination. The importance of this contamination from the standpoint of health and safety depends upon the composition of the spray. It may include lead-containing pigments or other harmful ingredients and in the case of lacquers, the solvent may contain benzol or other toxic organic materials. Even in the absence of highly poisonous compounds from the spray, it still contains substances that must not be breathed in the quantities that are released by spray painting. Furthermore, the solvents are usually inflammable and explosive, thus introducing a safety hazard. It is necessary, therefore, to confine the spray painting operation within an enclosure or booth which is constantly ventilated for the removal of the mist and vapors produced and in addition, certain fundamental precautions must be taken against the fire and explosion hazard. The essential details of design and operation of spray booths are

considered below. A typical installation is shown in Fig. 1 and the design of the booth itself is presented in greater detail in Fig. 2.

## Size of Booth

The cross-sectional area and depth of the booth are obviously determined

by the size and shape of the objects to be sprayed. The location of the operator is also an important factor in determining size. If he stands outside, as in the case of a bench booth, the cross-sectional dimensions are made as small as possible, consistent with the work and the only dimension of importance is the depth of the booth. This must exceed the fore and aft dimensions of part to be sprayed so that the spray gun may be held well within the booth during operation. This is desirable in order to minimize the escape of mist and vapors from the booth upon rebound from the object. Rebound and turbulence increase with the operating air pressure; hence, the depth must be increased with air pressure on the gun. The outside contamination due to rebound can also be minimized by installing internal angle baffles along the two sides and top of the booth at the edge, as shown in Fig. 2 at "K". Such baffles act as fire stops and are frequently recommended for this purpose by fire department officials.

When the operator works inside the booth, the dimensions must be such as to permit ample work room so that he may hold the spray apparatus well away from his face. Furthermore, the operator should be able to reach all parts of the work without finding it necessary to stand between the spray gun and the air outlet. In automobile spray booths, a minimum free distance of three feet is required on the sides, ends and top. One simple way to improve small booth design in this respect is to rotate the ob-

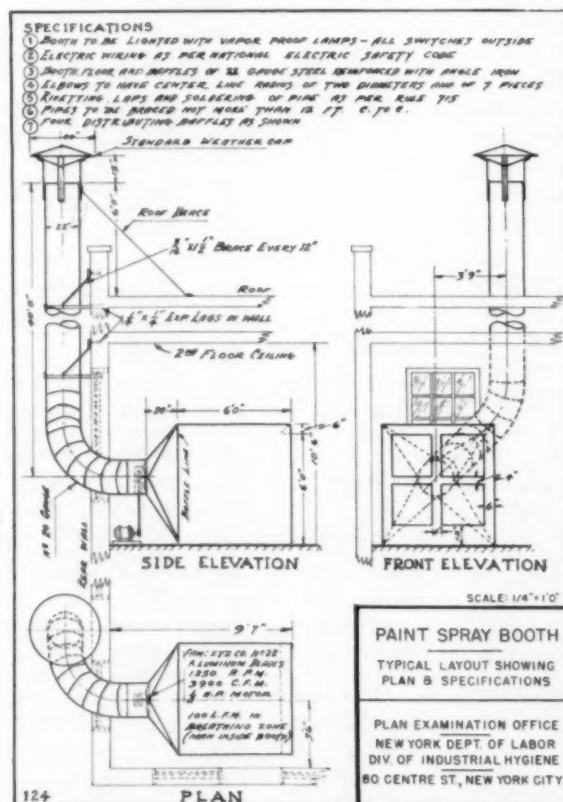


Fig. 1. Typical layout for paint spray booth.

\*From the Industrial Bulletin, State of New York, 18, (1939).



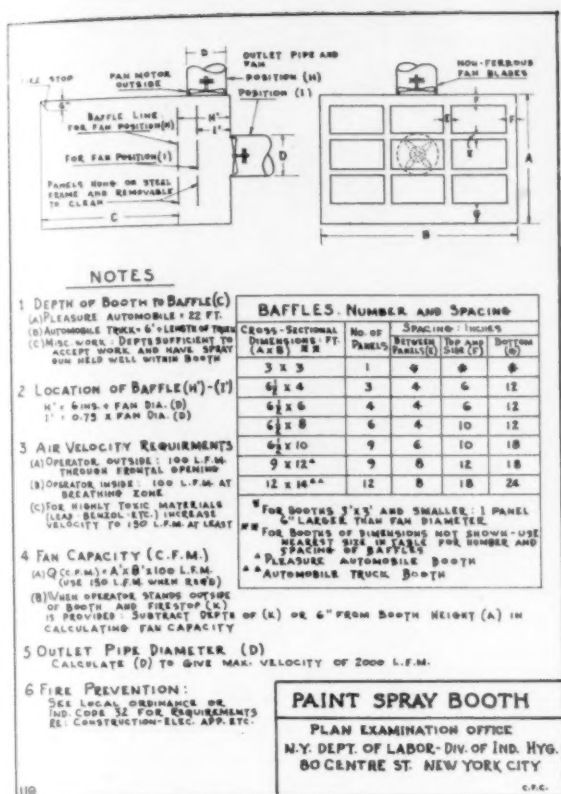


Fig. 2. Details regarding paint spray booth.

ject on a turn table which thus permits the operator to reach all surfaces without changing his position.

### Rate of Ventilation

The rate of ventilation to be maintained in a spray booth is determined by the air velocity through the zone of operation required to prevent the escape of the contaminating substance into the general room air. For most work, the minimum permissible air velocity is 100 LFM. It should be increased to not less than 150 LFM when lead, benzol, silica or other toxic substances are present in the spray and if there are no serious limitations, velocities in excess of these minimum values should be employed to give an added factor of safety.

When the operator works inside the booth, the minimum air velocity must be created at his breathing zone and the direction of airflow should be horizontally through the booth. In this case, the rate of ventilation is determined from the product of the specified air velocity and the cross-sectional area of the booth. Thus, as in Fig 2,  $Q (CFM) = \text{Min. Vel. (LFM)} \times A \times B$ . No allowance is made for reduction in the dimensions of the open end by baffles or fire stop. On

the other hand, when the operator stands outside the booth, the velocity through the frontal opening becomes the controlling factor and the rate of ventilation is calculated as the product of the required air velocity and the free open area of the booth. Thus, the use of a fire stop (K, in Fig. 2) or other baffles which reduce the operating opening, is recommended in order to lower the rate of ventilation and to save power and heat.

### Distributing Baffles

The air flow through the booth needs to be uniformly distributed so as to insure the same air velocity in all sections of the operating area. Spray booths are relatively short in depth compared with the cross-section area and the fan inlet is commonly abrupt.

Without some means for distributing the air currents, therefore, there will be high velocities in certain parts of the enclosure and insufficient air movement in other parts. One or more baffles are required across the booth at the outlet end to insure the proper distribution. Many combinations of number, size and spacing of baffles suggest themselves. The recommendations given in Fig. 2 have been found from practical operating experience to give satisfactory results.

An important added function of the baffles is to act as impingement plates for the collection of waste paint droplets, thus reducing the amount which passes through and adheres to the fan blades and walls of the piping. Such an accumulation reduces the fan efficiency, increases pipe resistance and lowers the rate of ventilation. It also constitutes a fire hazard. The arrangement of the baffles must be selected with this in mind and particularly, there should be as little open space as possible directly in front of the fan.

The baffles must be firmly mounted but readily detachable for cleaning.

### Exhaust Fan and Piping

In the typical installation, the air

outlet from the spray booth is direct to the outside atmosphere, either through a side wall or at a point above the roof. The piping is very simple and the resistance of the system low. Consequently, a disc type fan may be used, with the pipe diameter calculated to give a velocity of not more than 2,000 LFM, which corresponds to the fan inlet velocity commonly employed with disc fans. When, for special reasons, an unusually long discharge pipe is required, it may be more economical to employ smaller pipe, and a higher pipe velocity with a centrifugal fan as the exhaust apparatus.

The construction of the piping from the standpoint of low resistance and long life should follow modern engineering standards. Cleanout openings are needed near the fan and at bends.

### Point of Discharge

The point of discharge in relation to surrounding buildings is of importance since the escaping air contains solvent vapors and particulate matter. It should be extended not less than six feet above the roof and should be located as far as possible from any windows, doors or other inlets into occupied spaces. In certain cases, it may be necessary to reduce the amount of solid matter in the air before it is discharged to the outside. For this purpose, booths equipped with washing devices are available or impingement-type filters may be used in place of baffles in the end of the booth. Such air-cleaning devices are of no value in removing solvent vapors.

### Fresh Air Inlets

The rate of ventilation through spray booths is relatively large (10,800 cfm for pleasure automobiles) and careful consideration must be given to the provisions for the entrance of air into the room in which the spray booth is located to replace that removed through the booth. The essential requirements in this connection are:

- (1) The air should be clean to prevent contamination of the painted surfaces;
- (2) the air must be heated during cold weather to prevent chilling of the operations;
- (3) the fresh-air inlets must be so located in relation to the spray booth.

(Concluded on page 68)

# Rust Proofing Processes

By Carleton Cleveland

Highland Park, Illinois

This paper was written for Organic Finishing to present a short description of rust proofing processes commercially available. The processes described include: Bonderizing, Parkerizing, Granodizing and Alumilite. Metal treating solutions discussed include: Rusticide, Metalprep and Metaseal.—Ed.

## Introduction

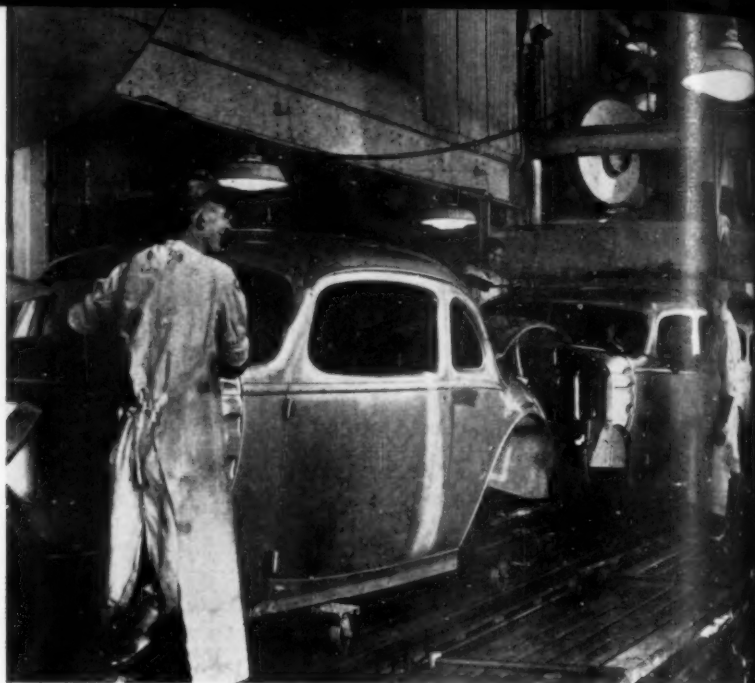
In addition to the aesthetic value—sales stimulating appearance—of an attractively finished metal product, the matter of durability must necessarily be considered, since that thought will inevitably present itself to the prospective purchaser. This fact has doubtless had much to do in furthering the development of the various pre-treatments recommended for metal surfaces which are to receive an organic coating.

Research has found that to lengthen the life span of metal products, it is not enough merely to apply a paint finish of superior quality, but rather the metal surface must first be rendered as nearly impervious to corrosion as possible, while at the same time making it a suitable base for the coating film to adhere permanently. "It is evident," writes F. N. Speller, in *Industrial and Engineering Chemistry*, October, 1938, "that metal corrosion and the paint problem are intimately related. To obtain the best protection of iron and steel by proper preparation of the surface is of fundamental importance."

Since all of the treatments designed to prepare metal surfaces for painting may not be expressly considered as

providing protection against the ravages of corrosion, it might be well to classify these treatments in respect to their results. In one group, such as alkali and solvent cleaning, the metal surface undergoes little change other than to be rendered free of any oil or grease accumulations, or other foreign matter, taken on during cutting, forming, grinding, or machining operations. Solvent cleaning, either by the immersion or the vapor process, is rapidly becoming popular as a preparatory treatment. It, like alkali cleaning, does not change the surface of the metal. It renders the surface chemically and physically clean. Products so cleaned must be painted while the product is clean.

Another group of treatments produces a surface-roughening of the metal treated. This may be accomplished mechanically by means of sandblasting or shotblasting, or chemically by an acid pickle or other method involving the use of an etching acid. Although the metal surface is etched or roughened, increasing the mechanical adhesion of the paint film, such treatments do not provide for the inhibition of corrosion, unless the finish coating is impervious to atmospheric conditions and is not subject to cracking or chipping from any cause.

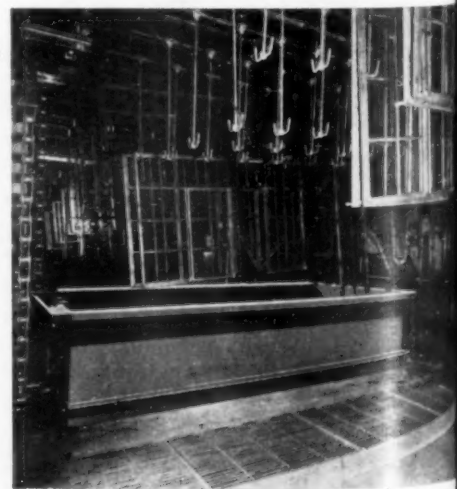


Workmen brushing Deoxidine on automobile

A third group, however, includes those treatments, or pre-treatments as they are frequently called, having for their purpose the transforming of a metal surface to a non-metallic coating. The aim of such a treatment is to protect the metal against corrosion and at the same time produce a surface that provides a satisfactory bond for the finishing coat. Chief among this class of treatments are Bonderizing, Parkerizing, Granodizing, Alrok and Alumilite Processes, Metaseal, Rusticide, and Metalprep.

## Bonderizing

Through the continuous efforts of its research department, the Parker Rust-Proof Company, one of the pioneers in the study and development of economical and effective rust prevention



Steel sash starting its trip through the Bonderizing process.





*Series of Parkerizing tumbling barrel tanks.*

for iron and steel products, introduced some ten years ago, the process known as Bonderizing, the purpose of which is to provide a rust inhibiting paint base that can be readily produced, assuring positive adhesion and durability of organic finishes applied on iron, steel, or zinc surfaces.

This is a chemical treatment. The solution coming in contact with the metal, changes the surface of the piece to a crystal phosphate coating, not as a deposit but as an inherent part of the metal. This coating is insoluble in water and therefore offers a high resistance to the effects of moisture.

Bonderizing, originally designed for the treatment of iron and steel only, has of more recent years been improved so as to include in its scope of effectiveness, hot and cold rolled steel, galvanized, galvanealed, zinc-coated, zinc alloy, cadmium surfaces, and zinc die castings. The process is used as a pre-treatment to inhibit rust and provide a base for paint, enamel, or lacquer finishes for automobile bodies, wheels, fenders, and hubs, as

well as refrigerator cabinets, washing machines, air conditioning equipment, medicine cabinets, steel window sashes, galvanized sheet steel, and numerous other products. It provides an absorbent coating which takes up a part of the finishing material when applied, and as the finish, which has entered the various crevices and cavities formed by the myriad crystals, dries, it is securely bonded to the metal, preventing chipping, peeling, and subsequent rust.

This process may be applied in either of two ways — immersion or mechanical spray under pressure — the choice being based on the product to be treated and the amount of production to be handled daily. The results of both methods are practically the same. Like all metal finishing methods, a clean surface is required before subjecting the metal to this pre-treatment, using either an alkali degreaser or solvent (either immersion or vapor) degreaser. The processing bath is prepared by mixing the necessary chemicals with hot water and either immersing the parts to be treated, or spraying them mechanically with the solution, for a sufficient time to transform the metal surface to a crystalline phosphate coating. The time required is generally from one to five minutes. Then follows a rinse of cold water and another in an acidified solution, after which the parts are dried and may then either be painted immediately or stored for a reasonable length of time before paint-

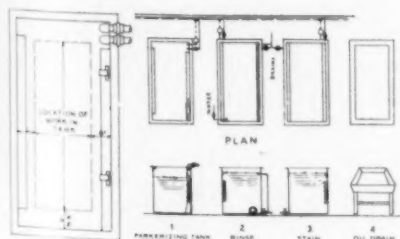
ing. The thickness of the coating is governed by the time of processing.

Zinc has long defied those who have wanted to give it a finishing coat of paint, but now that zinc-base die-castings are being used more and more to replace parts formerly made of iron or steel, it has been necessary to find a method of treating this metal to inhibit corrosion and to provide a bond to which the paint will adhere. There is also the problem of overcoming corrosion of the bare unpainted surfaces of such parts which function mechanically. When zinc corrodes, a change takes place which increases the part in size, which very often interferes with the proper working of that part. Then too, the corrosion particles themselves may become detached and cause trouble somewhere else in the complicated mechanism. Bonderizing is a method of inhibiting corrosion of zinc die-cast parts and of increasing the adhesion and prolonging the life of paint films applied to zinc castings and zinc-coated products.

### **Parkerizing**

This process, also developed by the Parker Rust-Proof Company, is one for rust-proofing iron and steel, and has been used by American industry for nearly a quarter of a century in plants both large and small where iron and steel are fabricated. Within recent months a new Parkerizing process has been announced, which combines all the effectiveness of the original process with some important new qualities that result in increased efficiency and lowered cost of application.

Like Bonderizing, it is a chemical process whereby the surfaces are changed to an insoluble phosphate coating resistant to corrosion, which when combined with stain, oil, or wax finishes, provides substantial protection from rust. And since it is a conversion process, which changes the surface without building up an additional outer coating or changing the original dimensions or shape of the product treated, it is well adapted to rust-proofing parts where close tolerances must be maintained. Forgings, castings, screw machine and wire products, automobile parts, parts of heavy machinery, architectural iron, as well as fine screws or products with fine holes or such as are intricate in design, can all be treated if they can be en-



*Typical tank layout for Parkerizing process.*



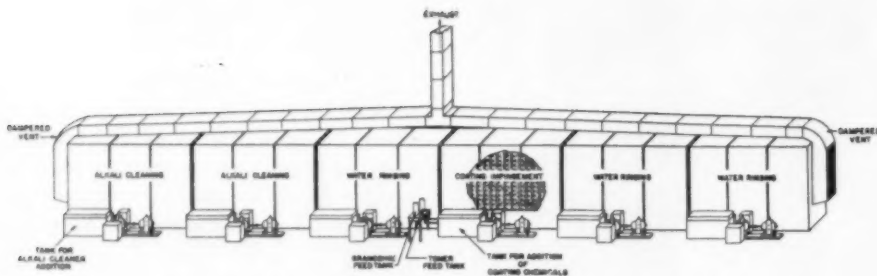


Diagram of typical Spray-Granodizing equipment. A six-stage machine.

tirely immersed in the processing solution. Small parts can be treated in bulk, in baskets or tumbling barrels, while the larger pieces can be suspended from racks. It is only necessary that the pieces be completely immersed, no electrical contacts are necessary.

Before iron or steel can be Parkerized, it must be freed from oil or grease, scale or other foreign matter, using an alkaline wash, a pickling operation, sand rolling or sand blasting, though metal parts which have been completely machined can be given this treatment without any preliminary cleaning operation. After the articles have been cleaned, they are immersed in the processing solution which has been heated by steam or gas. They are allowed to remain in the processing tank for the required time, and then are removed, rinsed, dried, and finished. The final operation is determined by the finish desired. Several finishes are available, one that is widely used is applied by sprinkling the product with a mineral oil; or if a deep black is desired, the product is first dipped in stain, and then given an oil treatment. High luster finishes are obtained by means of special oils and buffing.

The new Parkerizing process requires less time and lower temperature than the original process. The improved liquid chemicals develop less sludge and produce a finer grained, smoother coating, making it particularly adaptable for treating screw machine products and parts that require scientifically accurate measurements. All these improvements make for economies.

Parkerizing may be used for a paint or enamel base on iron, steel, and zinc, if desired. The processing leaves the surface highly absorbent, which forms a close union with the wet paint and thoroughly anchors it when dry. However, where baked paint finishes

are used exclusively, the Bonderizing process is generally recommended by the company.

### Granodizing

Among the various products of the ACP line issuing from the plant of the American Chemical Paint Company, are several designed to inhibit rust formation and provide a satisfactory bond for the application of organic finishes to metal surfaces. One of these products is Granodine, a "coating chemical used for producing a bond between paint and metal, and for preventing the development of defects in the paint finish." The treatment may be accomplished by either the electro, spray, or dip methods.

In Electro-Granodizing, the metal is subjected to a unique alternating current electrolytic process which plates the surface with a continuous coating of zinc phosphate, instead of depositing metallic zinc as is done in direct current electrolysis. The Granodine coating is dense and smooth. It provides a desirable foundation upon which to build lustrous and durable paint finishes, which may be applied immediately or after short periods of storage. This process is commonly confined to the coating of small parts, in either continued or intermittent production, with either hand or conveyor operation.

Spray-Granodizing is carried on in much the same manner as other pretreatment spray coating processes. Following a preliminary spray cleaning and rinsing, the metal parts are exposed to the Granodine spray for about one minute, followed by a final rinsing and drying, the complete process requiring approximately ten minutes.

Other ACP products used in the preparation of metal surfaces for painting are Deoxidine and Lithoform. The former is an acid cleaner that removes

oil, eradicates rust, and neutralizes rust-producers and creates an etched, inert surface on metal in preparation for a protective covering of paint.

In ordinary use, Deoxidine is diluted with two or three parts of water. When the application is to be made to large metal parts such as automobile bodies or a streamlined railway coach, the solution is flowed on with a brush. Smaller parts may be treated by dipping. When steel surfaces are thickly oiled, it is suggested that they be wiped with an oil solvent prior to the Deoxidine treatment. If parts to be treated present heavy rust spots, these should be scrubbed with steel wool or some suitable abrasive, so that the solution may make intimate contact with the steel. After a thorough washing and drying, the treated surfaces are ready for immediate painting.

The old masters are said to have used pallettes made of zinc when mixing colors, since the dried paints are easily scraped from the zinc surface with a palette knife. This indicates the peculiar characteristic of zinc. While it was a decided advantage to the old masters, it was to become a source of considerable annoyance and expense to modern industry. Indeed, the problem of making paint hold to galvanized (zinc-coated) iron is as old as galvanized iron itself. This paint-shedding characteristic is equally true of cadmium surfaces.

Research has pointed out that moisture, oxygen, and carbon dioxide (prevalent in the atmosphere) attack the painted surfaces of galvanized iron and react with the zinc or cadmium coating to form oxides and carbonates of these metals between the paint and the metal. The reaction which takes place between the metal and the fatty acids in the paint oils and the oxides and carbonates, gradually breaks down the bond between the paint and the metal. When such surfaces are Lithorized before painting, a dense, stone-like coating of zinc phosphate forms over the metallic surface. This coating is not affected by the temperature, and forms a firm inert bond for the paint finish.

Lithoform is a non-inflammable liquid chemical and may be used on zinc and cadmium surfaces as a pretreatment for all types of organic finishing—paint, lacquer, enamel, and japan, as claimed by the manufacturer. The Lithorizing procedure is similar

to other forms of pre-treatment in that it may be applied by brushing, dipping, or spraying.

### **Rusticide**

The Rusticide Products Company claims three outstanding features for Rusticide "50" Metal Cleaning and Rust-Inhibiting Compound;—(1) that it not only cleans metals thoroughly from oil, greases, drawing compounds, etc., but also removes rust, water stains, finger marks, etc.; (2) that it retards the normal chemical activity on the surface of metals (which, in connection with outside factors causes corrosion) and creates an insoluble surface which resists the factors causing corrosion; that it also neutralizes any alkalinity present on the surface; (3) that it creates a very mild etch which, in combination with the other functions mentioned above, offers good adhesion of finishes such as lacquers, paints, enamels, etc.

The chemical compound is supplied in concentrate form to be reduced with three parts of water. In practice it is recommended that the Rusticide solution be applied with a heavy brush, or, if preferred, by dipping or spraying. Hardly any time is needed for the solution to do its work. The second step is to wipe the article dry or sluice it in a hot solution containing about 1 per cent of Rusticide "50", which, it is understood, removes all traces of the cleaner and any dissolved waste. With the hot solution very little time is required for drying. Finishes can be applied almost immediately.

This chemical is non-toxic, non-inflammable, and does not harm fabrics,

thus operators and their clothes are in no danger whatever. Rubber gloves must, however, be worn to keep the skin from becoming too dry.

This product is principally used to condition ferrous metals prior to painting, although it is claimed that it is also suitable for aluminum, duralumin, nicrolium, galvaneal, and certain other types of metal.

### **Metalprep**

Another treatment, comparatively new, for cleaning and preparing metal for finishing operations, is Metalprep, manufactured by the Neilson Chemical Company, Detroit, Mich. This product is sold in concentrated liquid form, so that before it is to be used, it must be diluted with two or three parts of water to one of the material, depending upon the kind and condition of the metal to be prepared. The manufacturers claim for this product that it removes rust rapidly and completely, and inhibits the rusting agents which caused the rust to form originally, or which might set up new rust under the prime or surface coat; that it penetrates into the pit holes and to the base of the rust, stopping all further development of rust; that it at the same time removes oil, grease, waxes, rolling compounds and other foreign matter from the surface, leaving the metal chemically clean with an etched surface ready for painting. It is a product that may be used for preparing the surfaces of iron, steel and their alloys, aluminum, and the white metal alloys as duralumin, nicrolium, dow metal, cadmium, galvaneal, producing an etch on these active metals.

It may also be used for removing grease, impurities and corrosion from the non-active metals, such as lead, copper and brass, preparing these also for paint coatings.

This product is dispensed in lead. This too may be applied by either brushing, dipping, or automatic spraying. There are fifteen or twenty grades of Metalprep—each designed to meet a particular condition. In addition to these, special formulas are occasionally prepared to meet particular problems.

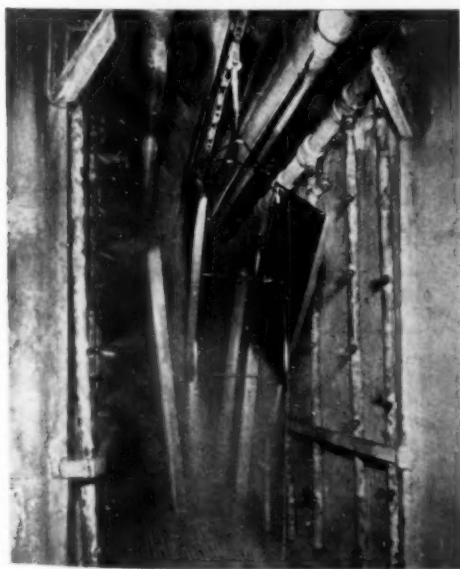
### **Metaseal**

A rust preventive which is new to industry and which may also be used as a bond coat for subsequent finish coats, is Metaseal. At present, however, it is principally used for protecting steel parts against rusting while being processed in factories or during storage before or after assembly. This is a product of the Surface Finishing Products Company, New Haven, Conn., and is sold as Metaseal 494, the numerals indicating the number of tests made before placing it on the market. It may also be used on brass, aluminum, etc., it is claimed.

This chemical is applied as a thin solution either by brushing it on, or using it as a spray or dip. It covers the objects with a tough film so thin that it can hardly be seen, and one that can be easily removed, if necessary, even after months of storage. Paints and enamels may be applied right over the Metaseal (some lacquers may, however, be excepted, as all have not been analyzed). Being a thin solution, knurled parts, threaded pieces, and those with or without holes can easily be covered. It is used warm in its natural state; flash point is high, is insoluble in water, and is said to have high specific heat. It is packed in one-gallon and five-gallon cans and in 50-gallon drums.

### **Alrok and Alumilite**

For aluminum there are several methods available for preparing their surfaces for protective organic coverings. Roughening or sandblasting or scratch-brushing, while sometimes employed, are not so desirable a practice, since they tend to impair the natural oxide film present on aluminum, rendering the metal more susceptible to corrosion, in case moisture should penetrate the paint coating. The simplest form of preparation is solvent



*Parts suspended from trolley conveyor passing through Spray-Granodizing chamber.*





*Alumilite dry plate being made on a treated plate having a hard and durable surface.*

cleaning, according to the Aluminum Company of America, the improved form being solvent vapor degreasing. While this adequately meets the need for securing a clean painting surface, it is not sufficient for the more severe conditions of exposure.

For this purpose, there are two general types of treatment recommended by the Aluminum Company of America,—mild alkaline solutions of the sodium phosphate or sodium silicate type, and dilute acid solutions containing phosphoric acid. The alkaline solutions clean aluminum surfaces without seriously attacking the metal, and are considered fairly effective in securing good paint adherence. The phosphoric acid solutions, on the other hand, are more effective, this company asserts, usually containing water, alcohol, or some organic solvent in addition to phosphoric acid. These solutions appear to form a thin layer of aluminum phosphate on the surface of the metal, providing a suitable protection against corrosion. There are also a variety of proprietary treatments of this type that may be used.

One such proprietary method is a patented chemical process called Alrok, used either as a protective finish for aluminum surfaces or as a preparation for the application of paint finishes. "The best surface preparation for the painting of aluminum and

its alloys," suggests the Aluminum Company of America, "is obtained by means of anodic coatings." The patented, Alumilite process producing a corrosion-resistant, adherent, impervious oxide film constituting a good base for paint—is one of these anodic treatments. The process differs from electroplating in that the articles to be treated are, as in some of the other treatments, attached anode rather than cathode in the electrolyte, oxygen being deposited to combine with the aluminum to form aluminum oxide, integral with the surface of the metal.

While the various methods described may seem more or less similar, yet many factors should be considered by the manufacturer before deciding upon any one specific process of preparing metal for painting. Much depends upon the quality of his product and the length of its useful life. Cost of application and adaptability of the method chosen necessarily are factors, also whether the painting is immediately to follow the cleaning and pretreatment of the metal.

#### EXHAUST BOOTH DESIGN

*(Concluded from page 63)*

tion to the booth that short-circuiting through the booth does not occur.

On continuous production oper-

ations, it is often desirable to deliver the fresh air direct to the enclosed spray booth, providing air filters, heaters, fan and piping for this purpose as part of the complete installation.

#### Fire Prevention

The design requirements with respect to fire prevention are, for the most part, dictated by common-sense. These may be listed as follows:

1. The booth, floor, baffles and all other parts of the system must be constructed of fire-resistive materials. For automobile spray booths, the fire-resistive floor must extend at least four feet beyond the open sides and must not be constructed of ferrous metal.

2. To prevent unnecessary accumulations of paint and to facilitate cleaning, the inner walls, ceiling, baffles and floor of spray booths must have smooth surfaces and a program of routine cleaning of all parts of the ventilating system is required.

3. Fan blades must be of non-ferrous metal to prevent spark formation.

4. All electric lights inside the booth must be of the vapor proof type and no switches, motor starter or other sparking devices should be located within 10 inches of openings in spray booths. Electric wiring should be enclosed and otherwise follow the requirements of the National Electric Safety Code.

5. Main supplies of spray material and thinner must be stored in a fire-proof storage building and all mixing should be carried on in this building which must be adequately ventilated.

#### Personal Respiratory Protection

The rates of ventilation recommended above are sufficient in most cases to prevent the contamination of the general room air but do not necessarily afford complete protection to the operator, particularly if he works within the spray booth. Personal respiratory protective equipment is therefore required for the operator when spraying toxic materials such as lead, benzol, etc., and the use of such equipment is also recommended even when the spray material is not highly toxic. Respiratory protective equipment specially designed for this purpose is available commercially.

The proper use of such equipment involves the daily cleansing and repair and storage when not in use in clean containers.



# Useful Pointers

## for the Japanning Department

By Frank V. Faulhaber

This is the concluding portion of the article by Mr. Faulhaber, the first part of which appeared in the November issue.

There is a vast range of opinions and preferences as to the most appropriate heating temperatures. Too, each plant has different problems, different products, and different outputs. The character of finishing coats also is a determining factor. A fairly successful procedure is to run the temperature up to 375 or 400 degrees, in from  $1\frac{1}{2}$  to 2 hours, then holding it there for half an hour, until baked. No explicitly set rules of time and temperature can be given. Experiment and counsel with japan makers' representatives should be made. Too much tab on the work cannot be kept; the temperature should be noted, every 15 to 20 minutes, comparing the records of different bakes with the results obtained. Automatic temperature recorders are of great help.

In the object for uniformity, as respects the baking of dead blacks, it should be borne in mind that the high points of temperature should be about the same for each bake, for there is usually a duller bake at a higher temperature.

The gilsonite japons can be baked at high temperatures, 400 degrees to 500 degrees, without decomposition of the gum, the resulting film depending upon the character and quantity of oils used in its composition.

Certain products that incorporate wood in their construction, however, cannot be baked at high temperatures; also units comprising metal parts made up of alloys such as babbitt, and the like. High temperatures cause warping in the wood, and melting of the alloys. Where the nature of the product requires it, low heat baking

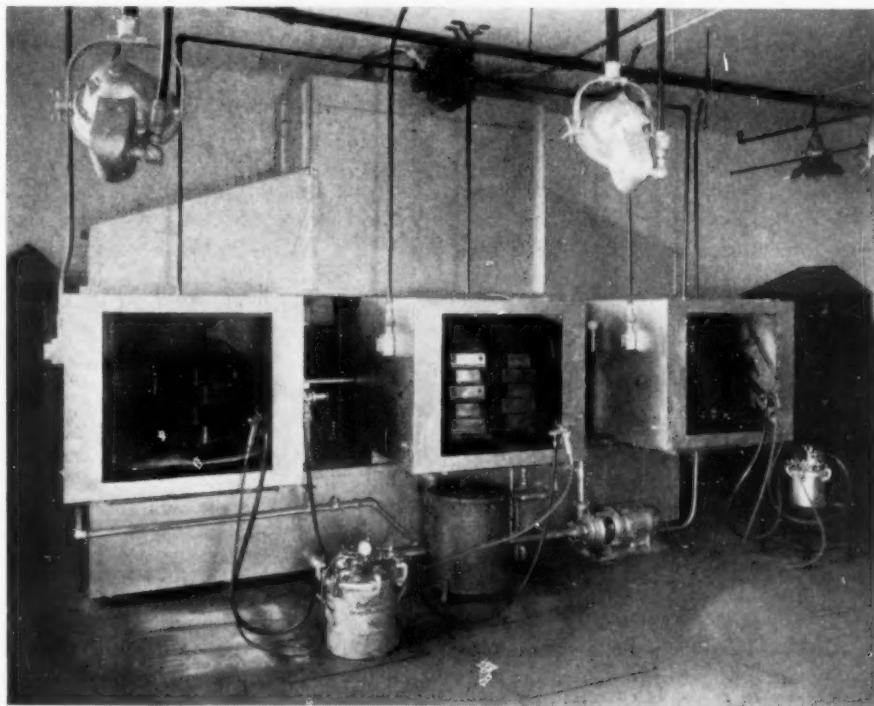
japons can be employed, the distinguishing characteristic from high heat japons being that they contain more dryers and fewer semi-drying oils. There is no difference in application.

Since dirt can be readily discerned in a japan before it is baked, during baking, and also after it is baked, any trouble can be traced easily enough. When the japan in the dipping tank becomes dirty, the tank should be emptied and after washing the sides and bottom with reducer, the japan should be strained back into the tank through the strainer. Japan will flake off when put on over a rust spot or

metal washed in alkali and not thoroughly rinsed, or if too many highly baked coats are applied, or again, when overbaked. When the finish flakes off for any other reasons, a better grade of japan should be used.

When some of the work is satisfactory, while certain of the units come forth partly defective, it indicates that part of the metal has not been cleaned properly, or there may be something at fault with the oven—poor ventilation or variance in heat. When the japan itself is, in any way deficient, then the entire ovenful will process poorly. A few simple tests will generally reveal where the trouble lies, whether with the japan or the operation.

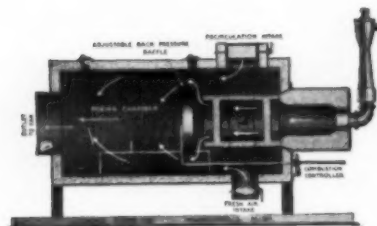
The japan under question can be flowed onto a piece of ordinary window glass, or this glass can be dipped into the material and then baked in the



Booths for spray japanning of steel boxes.

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same oven beside another piece of the work showing to poor effect. Enlightening revelations should ensue. When the finish on the glass develops satisfactorily, it is absolute proof that the trouble is not in the japan, but in the metal. When the finish on the glass comes out poorly, the japan properly may be suspected, yet further experiments are advisable. For illustration, a cup or so of the japan should be taken from the container, reduced, baked on glass and metal, and the results compared with those from the dipping tank.

Sometimes the vapors issuing during the baking operation are not carried off fast enough, because of poor ventilation, with the result that the finish may show a mottled effect. To

obviate this, it may be advisable to experiment by keeping the oven door partly open for awhile during the baking. This mottled appearance, however, is usually the fault of the japan. Only by individual tests and results can the true source of a given trouble be determined.

The finishing operators should be cautioned about correct quantities of material, no matter what the operation. A bluish cast, for example, may be caused by poor ventilation, and yet it is frequently due to reducing with too much kerosene. Another japanning disappointment is occasioned by wrinkling. This usually results when too heavy a coat has been applied, not allowing it to drip long enough, and then running the heat up too rapidly,

or because of improper baking temperature. When only part of the japanned work in the oven wrinkles, it will be found to be that portion of work nearest the burners, which must be guarded better to overcome this deflection.

Another japanning difficulty results when the japan sags or overlaps. Also, when there are holes in the metal, long unsightly streaks will develop beneath these holes. A sagging, uneven coat often results, when the thinner has not been stirred thoroughly. A good-quality japan, competently reduced, should not sag, overlap or streak. Poor flowing is the cause of these troubles, and sometimes a little kerosene will help.

Another annoying and bothersome defect is had when faint, silk-like lines run through the finish, killing the lustre. It is frequently observed, more or less, in poorly made coats, but it should never appear in the finishing coat. It may be caused by the silk in the first coat showing through the more transparent finishing coat, or it may result when the finishing coat has been applied too heavily or, again, when the japan is applied too cold and not allowed to drip long enough prior to baking. The trouble also will occur when the heat is run up too rapidly.

Troublesome, too, is pitting, the work coming from the ovens being partly or completely covered with small pit marks or sometimes large blotches. When this happens periodically, it is caused by over-heating, moisture gathering on the walls of the oven. By heating the oven with the door open awhile, before using, the trouble can be overcome.

As previously indicated, pitting is caused more often by grease on the metal, which must be removed completely, before a first-ranking, quality japanned finish can be obtained. When greasy metal is dipped for any length of time, it will cause the japan in the dipping vat to become impregnated with grease and such japan will pit on all products.

Many finishing plants, otherwise well prepared, are woefully handicapped because of lack of proper equipment. Today, modern machinery, devices, and materials enable the plant to process a better quality of japan work, at every phase of the business. Improved methods position the progressive plant to put through a greater volume of orders and generally enlarge its output.

## Solvents in Industry

### Normal Butyl Alcohol (Butanol)

#### Physical Properties

Normal butyl alcohol is a colorless liquid of somewhat sharp odor, having a position between propyl alcohol and amyl alcohol in the series of normal primary alcohols. It has the chemical formula  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$  and a molecular weight of 74.08. Unlike propyl alcohol, which is entirely soluble in water, normal butyl alcohol is relatively insoluble and in this respect is closer to amyl alcohol. However, it is miscible with most organic solvents and either alone or in combination with other solvents provides good solubility for many natural and synthetic resins. A list of solubilities of normal butyl alcohol with various materials is given below.

Normal butyl alcohol is listed as having a specific gravity of 0.8108 at 20/20°C., a boiling point of 117.9°C. at 760 mm pressure, a melting point of -89.8°C. at 760 mm. pressure, a vapor pressure of 5 mm. of mercury at 20°C. and a solubility of 8.3 grams per 100 grams of water at 20°C.

In addition to the normal type, there are three isomers of butyl alcohol. These are isobutyl alcohol, secondary butyl alcohol and tertiary alcohol. All four types possess the same molecular weight but have different molecular arrangements and properties.

#### Chemical Properties

By reaction with acetic acid, normal butyl alcohol will produce butyl acetate, one of the most important medium boiling solvents for nitrocellulose. It can also be used to produce butyraldehyde and butyric acid, from which butyric esters are prepared by catalytic oxydation.

#### Physiological Properties

The physiological hazards entailed by the use of butyl alcohol are considerably less than those of benzol or the chlorinated hydrocarbons, such as carbon tetrachloride. Smythe in his experiments on the inhalation of lacquer solvents concludes butyl alcohol to be somewhat more toxic than gasoline, turpentine, and xylene. The alcohol should not be used continuously without adequate ventilation.

#### Manufacture

Two processes may be used for the production of normal butyl alcohol, namely a process of fermentation or through a series of chemical reactions by means of which it is obtained synthetically. The fermentation process was actively developed during the last World War, originally to supply acetone required in the manufacture of explosives. In addition to the acetone, the process produced carbon dioxide and hydrogen and large quantities of butyl alcohol

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which was a by-product with no immediate use. It was found, however, that butyl alcohol and its derivatives such as butyl acetate and butyl phthalate were excellent as solvents for the then new nitrocellulose lacquers. Shortly after the end of the war, therefore, the fermentation process was expanded, not for the acetone for which there was now relatively little use, but for the butyl alcohol which was in increasing demand for use in lacquers.

The manufacture of normal butyl alcohol by fermentation uses raw materials similar to those of alcoholic fermentation with yeast. Included are corn, rye, molasses, rice and even manioc and horse chestnuts. The first three, namely corn, rye and molasses, find the widest use, the exact one depending on price and availability. Carefully prepared mash is first sterilized to remove all microorganisms which might produce materials other than those desired. The mash is then inoculated with spores of a special bacillus, known as Weizmann bacteria, and allowed to ferment for a number of days in air-tight vats at carefully controlled temperatures.

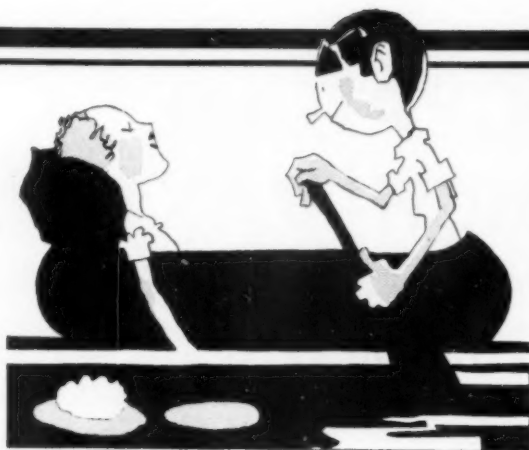
The liquor from the fully fermented mash is finally distilled to give a mixture of normal butyl alcohol and water.

Synthetic normal butyl alcohol is made from either acetylene or ethylene under exactly controlled conditions in the presence of a catalyst. The product thus obtained has been found to be very pure and recent developments in the process make it competitive with the product of other methods.

#### Uses

Normal butyl alcohol alone is not a solvent for cellulose nitrate, but in combination with other solvents gives good solubility and tends to reduce blushing. Butyl alcohol is also used in oleoresinous and spirit varnishes. At room temperature it will dissolve up to 19.5% of its weight of water. In addition it forms a constant boiling mixture with 37% water, boiling at 92°C., and is useful as a dehydrating agent. It is used in the saponification of fats resistant to ordinary alcoholic soda, to some extent in making fruit essences and in the manufac-





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ture and processing of plastics and film. Because of its mutual solubility for immiscible substances it acts in many cases as a blending agent. It is also an anti-foaming agent and a surface tension depressant.

In connection with organic finishes it finds use in the manufacture of airplane dopes, lacquers, paint and varnish removers, enameled leathers, shellac solutions, spirit varnishes.

### **Solubility of Normal Butyl Alcohol with Various Substances**

Ethyl Alcohol	Soluble
Ether	Soluble
Toluene	Soluble
Gasoline	Soluble
Linseed Oil (raw)	Soluble
Cellulose Acetate	Insoluble
Shellac	Soluble
Kauri Gum	Soluble
Dammar Gum (dewaxed)	Soluble
Ester Gum	Soluble

## New Equipment and Supplies

### **Corrosion Resistant Process for Aluminum**

The Colonial Alloys Co., E. Somerset and Martha Sts., Philadelphia, Pa., have announced the development of a new method for treating aluminum and its alloys.

The process involves a chemical reaction between the "Colseal" compound and the metal, creating a molecular bond. This treatment is claimed to prepare the metal surface so that the adhesion of paints, lacquers and other organic finishes is markedly improved.

The combination of Colseal and organic coating is stated, therefore, to produce high protection against salt water and other corrosive media.

The cost of the treatment ranges from  $\frac{1}{8}$  to  $\frac{1}{2}$  cent per sq. ft., and the equipment required is a steel tank for the processing and two wooden or steel rinse tanks. The processing time is from 5 to 7 minutes, depending upon the type of alloy.

The manufacturers report that extensive tests for 18 months made with aluminum parts treated before varnishing with various metal treating processes, showed that the Colseal panels were devoid of corrosion even after 18 months, whereas the remaining panels were corroded within 3 months, in spots.

### **Air Convection Ovens Up To 500 Deg. F.**

The Harold E. Trent Company, 640 North 54th St., Philadelphia, Pa., have developed for the paint and varnish trade a special type of electric oven, heated only by convected heat. The performance specifications demand the following:

- (1) Uniform temperature. Maximum tolerance plus/minus 2 deg. F. (This of course is different from 1 to 2 deg. F. at point of control.)
- (2) Uniform results, i.e., that work taken from the oven in any part shall be the same.
- (3) Adjustable venting for elimination of fumes.
- (4) Ability to vary the electrical energy to suit temperature and load in oven.
- (5) Explosion proof door.
- (6) Both air circulation and heating units cut off by opening the door.

In the past it was found possible to get even temperature in the oven but the effectiveness of radiant heat alone or convected and radiant heat did not permit uniform results, even when the heaters were shielded by metal shields. By arranging the position of the heating elements, blower, air ducts, and careful selection of a combination of material, conditions are realized to meet the exacting specification.

This type oven has been made at present in two sizes, viz:

#### **Inside Dimensions:**

30" wide x 30" deep x 60" high  
30" wide x 18" deep x 24" high

The ovens are claimed to be well and sturdily constructed with four inches of insulation. The complete equipment consists of, in addition to the oven, magnetic switch, motor starter, fuse control switches, snap switches for connecting the heating elements, and an indicating or recording temperature control instrument.

The heating up time to 400 deg. F. has been arranged for one hour. Of course, when lower energy is used, by operating one or more of the switches, the heating up time, as well as the best value of applied heat, can be obtained. The work produced by these ovens is, according to the manufacturer, uniform and there is no difference in color or results obtained in any location in the oven.